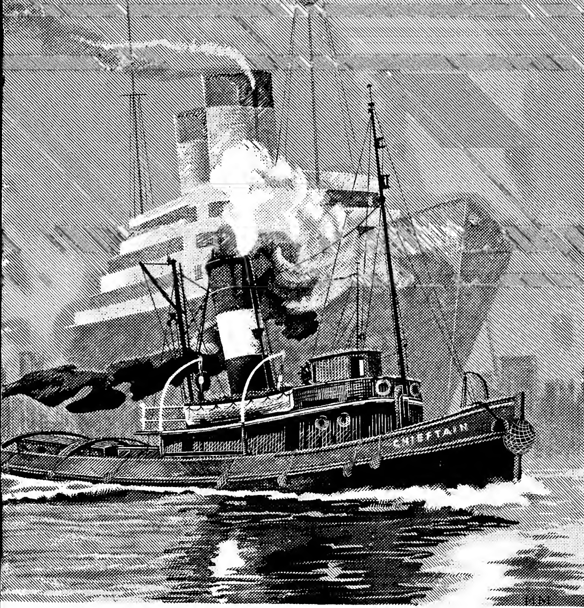
THE MODEL ENGINEER



Vol. 96 No. 2384 THURSDAY JANUARY 16 1947 9d

THE
MODEL ENGINEER
Percival Marshall & Co. Ltd., 23, Great Queen Street, London, W.C.2

SMOKE RINGS

Our Cover Picture

I HOPE you will like our cover picture this week, which shows a busy scene on the River Clyde, near Renfrew. We often hear the expression "fussy little tugs," but here is a tug full of life and power, by no means "fussy," hustling along to do a real job of harbour work. I think our artist, Mr. Mudge-Marriott, has caught the feeling of power admirably, and I should not be surprised if his enthusiasm for his subject inspired model shipbuilders with the thought that modelling a tug, particularly a working model, had possibilities not hitherto fully realised. For the photograph on which the drawing is based we are indebted to Mr. A. G. Ellis, who was busy with his camera on the Clyde during a recent holiday.

A Ban on Wind-power

AN extraordinary ruling has been given by the local Ministry of Fuel officials in Edinburgh, forbidding the use of a small wind-motor electric plant for lighting a shop in the city. Their argument was that if everybody followed this practice the Ministry would need a large staff to check up on all the devices used. Wind-power is used in numbers of instances for electric lighting, pumping, irrigation, and indeed, the windmill itself has been a common object of the countryside for centuries past. Perhaps the Ministry will go a step farther and prohibit the use of water-power for similar purposes, and for mill and factory driving in general. What nonsense this all is. The Ministry ought to be only too pleased to see natural sources of power used in this way to save consumption of both coal and oil, and should commend individual enterprise of this kind instead of imposing pettifogging and unnecessary restrictions. It is official control running riot, and I cannot see the local ruling at Edinburgh receiving the endorsement of the powers that be at headquarters. While on this subject, I might mention a letter from a correspondent who has been looking into the use of wind-motors in another part of the country, and tells me of an installation where the contractors had erected a wind-motor close against the side-wall of a house. How they expected the motor to function in this quiet sheltered position he does not know. Nor do I, but it is curious how dumb some people can be!

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A Swiss Centenary Railway Exhibition

THE YEAR 1947 will be the centenary of the first railway in Switzerland, and this event is to be celebrated by many interesting functions in that country. The most important of these is the Swiss Railway Centenary Exhibition, which is to travel round the country, staying at various cities and towns, between April 5th and November 30th. With this exhibition, a full-sized reconstruction of the first train, run entirely on Swiss

ground, will be in service, and on August 9th, 1947, this train will run over the same ground, from Baden-Zurich, as its original did just exactly 100 years ago. When the line was first opened it had four locomotives, thirty passenger coaches, and ten wagons of different types. There is also to be an exhibition of five complete model trains, to a scale of one-tenth, to show various time periods in the history of the Swiss Federal Railways, and these are being made by various model makers of the Swiss Clubs.

An Exhibition Journey

A LETTER from Mr. F. Schiff, of Amsterdam, tells me of his somewhat strenuous adventures in visiting our 1946 Exhibition. It is good to know that he succeeded in getting through with happy results. He writes :—"So many fellow model engineers have described their voyages to your exhibition that I feel inclined to do the same. The British Embassy here is very reluctant in giving visae, but after spending three full days there in a crowded waiting-room I finally succeeded in receiving mine. I crossed from Hook of Holland to Harwich in the night of August 28th/29th, which was described in the English newspapers as the stormiest of the season. Instead of arriving in London at nine o'clock on Thursday morning, I did not get there until eleven. From Liverpool St. Station I went at once to Vincent Square, and got there just when the gates opened. I went to the Exhibition three days in succession, thoroughly enjoying it. After the Exhibition had closed I stayed a few more days in London, calling on some old friends. As I had not seen London yet after the war, I found it a very interesting visit."

Calling Hayes, Middlesex

A MODEL engineering club for the Hayes district of Middlesex has been proposed, and any reader who may be interested in the scheme is invited to communicate with Mr. Gordon Green, 19, Crowland Avenue, Hayes, Middlesex, to discuss the proposition. What about it, Hayes model engineers?

Any Complaints!

MY self-esteem received rather a set-back a short time ago when I opened a letter from a Birmingham reader making two complaints about THE MODEL ENGINEER. My correspondent said that in its present form it failed to hold his interest for more than about 15 minutes. "Let your experts," he wrote, "look back to the volumes from 1920 onwards and they will get some ideas." I could not help thinking of the story once told of Sir Francis Burnand, then editor of *Punch*, when a reader said to him, "You know, Sir Francis, that *Punch* is not nearly as good as it used to be." He replied briefly, but very effectively, "It never was." The truth is that journals, like people and fashions, change with the years. Let my correspondent pick up any journal he likes and compare it with issues of that same journal published twenty-five years ago. He will find a difference which may be pleasing or otherwise, according to whether his own ideas and interests have changed with the times. If it is to live, a journal must keep pace with the changing interests of its readers, and must reflect the developments which have taken place in the field for which it caters. Model engineering has changed very much in the last quarter of a century. A new generation of readers and contributors has grown up, and while the same love of good craftsmanship prevails, the products and methods of the home workshop have undergone many changes. A glance through the past few volumes of THE MODEL ENGINEER will show how faithfully our journal has kept pace with these developments without unduly neglecting the interests of those who love the prototypes of bygone days, a period so rich in inspiration for the historic mind. My correspondent makes a further complaint that our advertising pages are not as representative of the model engineering trade as they used to be. "Why," he asks, "do you not go out into the world of engineers and toolmakers and bring them within your field?" There are two answers to this. One is that for a long time past we, in common with other publishers, have been restricted by the Paper Controller in the space we are allowed to devote to advertisements. A further reply is that many of our pre-war advertisers have been, or still are, occupied with Government contracts and have not yet got into their stride again in catering for model engineers. Moreover, those who are getting back again into model engineering, and the new firms who are coming into this field, are still much hampered by the shortage of materials and by official controls affecting supplies. I would thank my correspondent for the trouble he has taken in writing me. An honest complaint is, in a sense, a compliment, for it shows that the aggrieved party is sufficiently interested in his favourite paper to try to have its failings, if such exist, remedied. I do not claim that THE MODEL ENGINEER is perfect, but it does at least honestly endeavour to satisfy and help as many of its readers as possible. A peep behind the scenes such as I have endeavoured to give in the foregoing lines may help to explain some of the problems which confront the stage manager. To restore my self-esteem, for I am very proud of my little paper and its readers, I pick up two other letters on my desk. One is from a reader who has just obtained a new and attractive workshop job, a success he attributes to the practical instruction he has gained from the pages of THE MODEL ENGINEER during recent months. The other is from an engineer high up in the ranks of the profession who says: "THE MODEL ENGINEER now, *more than ever*, is one of the week's most pleasant anticipations for me. Should my eagerly awaited copy, by some mishap, be delayed, I become distressed until its cheery face bids me welcome." Those words "more than ever" answer my complainant so effectively that I feel justified in lighting my pipe again in peaceful "Smoke Ring" reflection.

Percival Marshall

By K. N. HARRIS

*Reconstructing A STUART-TURNER No.1 ENGINE

WHEN the old piston was mounted on the new rod it was not true; as it had been perfectly true on its original rod, investigation followed and showed that it had evidently been machined on the rod, and that the reduced portion of the latter on which it fitted, was slightly out of truth with the main body. A check showed that the piston was only true in one position. A new solid piston was made from centrifugally-cast iron rod (the original piston was in two halves) and turned to a close tolerance in the bore, actually about — 0.0006 in., the groove being cut ¼-in. wide.

A single "Clupet" ring was fitted, and for the benefit of those not familiar with this most excellent device, it may be explained that in effect it is nothing but a glorified old-fashioned key-ring, of course, rectangular in section. These rings are made by a special process, and so hammered that they give equal pressure all round. As will be noted, this construction avoids a through g p. Fig. 4 shows such a ring. I have used these rings on steam, oil and petrol engines, air compressors, vacuum pumps, refrigerator compressors, etc., always with complete success; they give an excellent gas seal with a minimum of friction. This, incidentally, was the only new thing in the reconstructed job which I did not make myself, including all the nuts, bolts, studs, and screws.

The link-motion is detailed in Fig. 8a, together with the eccentric setting, and the slide valve and port face is shown in Fig. 5.

The eccentrics were made separately from nickel chrome steel (by accident I picked up a piece in mistake for mild, but carried on with it, as though tough to machine, it takes an excellent finish and should wear very well indeed). They were turned up with a central rib and faced on one side and then parted off.

A brass holder was made by boring a suitable bush to close fit on the rim, marking its position in the chuck, splitting it, re-mounting with an eccentric gripped machine face in, the rough-parted face then being machined.

The same holder was then mounted in the four-jaw with its centre offset by 7/32 in., and the eccentrics mounted (one at a time) and bored to suit the crankshaft. They are held to the crankshaft by No. 2 B.A. "Allen" socket grub-screws, preliminary setting was effected, using ordinary mild-steel screws with flat ends, so as not to damage the shaft. The eccentric straps were made from the same grade of hard rolled brass as was used for the slide valve. A groove is cut in the centre of each to coincide with the rib on the eccentric for location purposes,

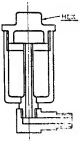


Fig. 7. Crosshead lubricator

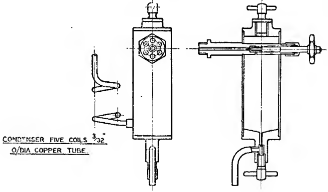
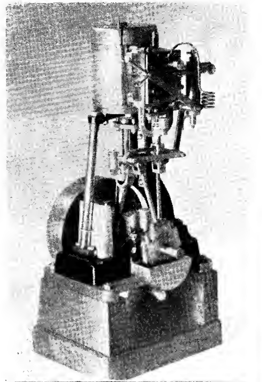


Fig. 8. Displacement lubricator

**Continued from page 22, " M.E.," January 2, 1947.*



Finished engine, half front view

the straps are held together with silver-steel bolts with locknuts. Each strap embodies an oilbox. Setting eccentrics is a tedious job if you have to remove the straps for every adjustment, so to get over this, I drilled a hole in the bottom half of each strap, centrally, through which the hexagon key for turning the "Allen" screws can be inserted and any adjustments to the eccentric setting can, in consequence, be made without disturbing anything. This method is only possible when using the "Allen" type of grub-screw, as a hole large enough to pass a screwdriver would be too big and would unduly weaken the strap.

The eccentric rods are each built up of three pieces; a foot or palm, the main body and the fork, all in steel; the palm and fork in mild-steel and the rod in silver-steel; both palm and fork are spigoted, and silver-soldered on to the rod which is of tapered circular section. The whole motion is symmetrical about the centre line of the valve spindle. The eccentrics are $\frac{5}{16}$ in. wide each, so that as their faces meet on the centre line of the motion, each eccentric-rod has to provide an offset of 5/32 in. between their centres and the centre line of the link. This is obtained by offsetting the palm $\frac{1}{16}$ in. from the centre and the fork 3/32 in., making the required total of 5/32 in.; the two eccentric-rods are identical—not handed.

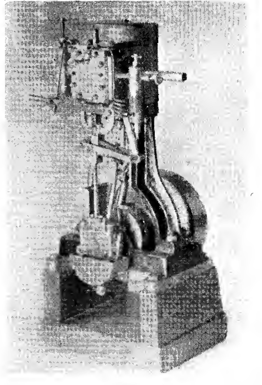
The link is made from a piece of $\frac{1}{4}$-in. thick ground stock, and its block from the same kind of material. Both were made entirely by hand methods (apart, of course, from the drilling of holes).

Incidentally, work of this nature is an excellent test of one's ability to produce accurate work with a file, particularly with reference to the accuracy of fit and free working of the block in all positions of the link. The eccentric-rod pins are plain lengths of $\frac{3}{16}$-in. silver-steel, they are pinned to the eccentric-rod forks and rock in the link. After fitting the holding taper pins, the main pins were removed and hardened and tempered.

The drag-links are fairly long and are plain strips of mild-steel with rounded ends; they were drilled as a pair to make certain of square alignment.

They are held together as a unit by two double-ended double-shouldered pins, the pin which passes through the link has two collars on it to keep the drag-links centrally located about the main links.

The reversing drop-arm boss at the other end is of a length equal to the space between the links, less working clearance. The drop arm and lever are a built-up unit made in mild-steel and brazed together, the round handle of the reversing lever is itself separate from the body of the lever which is spigoted into and brazed to it. The anchoring



Finished engine, half rear view

of the drag-links to one end of the curved link is not ideal from a steam distribution point of view, but as the drag-links are comparatively long, its effect is not serious.

The lever is locked by a sleeve and drawbolt through which a hinged bar fits, the bar being carried by a bracket from the top of the steam-chest. Stop collars are fitted to this locking bar to prevent the gear being forced over too far in either direction; this type of locking gear is simpler than a notched quadrant, gives an infinitely variable cut-off, and is good small marine practice anyhow.

Returning for a moment to the main "power line" of the engine, i.e., crankshaft, main bearings, connecting rod and crosshead, certain modifications were carried out.

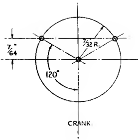
The first job was to refit the main bearings and big-end bearing; this was done by facing-off the joints plus a little judicious scraping, the wear was not serious and the job did not take long.

Next, balance weights were fitted to the crank-webs; these are detailed in Fig. 6. They were made from gunmetal, partly because it is appreciably heavier than steel, and all the weight possible was wanted, but also because it happened to be handy, and is rather easier to machine. The weights were made up as machined discs, one for each weight, and afterwards the unwanted surplus was cut away; the slots to fit over the crank-webs cut out and fitted, and holes drilled and counterbored for the holding screws. These are special screws made from silver-steel, their heads being accommodated in the counterbores. A new silver-steel wrist pin was made for the crosshead and connecting rod. This is held in the connecting rod and turns in the crosshead; it is "snugged" to the connecting rod and held by a fine thread nut which has a split pin behind it.

The wrist pin is drilled with a 3/32 in. hole from the small end nearly through, a shallow groove is cut in the body of the wrist pin about its centre line and a cross hole drilled through this, communicating with the centre hole; the outer end of the centre hole is finally plugged after clearing out all traces of cuttings.

A 1/8-in. diameter copper pipe is carried from the head of the wrist pin (it fits in the hole mentioned above) down to the foot of the big end, through which it communicates with the brasses. The crosshead had a 3/32 in. hole drilled transversly through the centre of the wrist pin axis from back to front, the front portion of the hole was opened out and tapped 5/32-in, 40 t.p.i. Across the back of the crosshead, where it runs on the guide, and coinciding with the hole was cut a shallow groove not quite breaking out at the sides, and through the two ends of this were drilled two No. 56 holes to lead oil to the front side of the slipper.

Into the 5/32-in. tapped hole in the crosshead was fitted an elbow, and into this in turn a fair-sized wick-feed lubricator, which is illustrated in Fig. 7. The net result of this somewhat complicated sounding, but really quite simple procedure, was that this one lubricator looks after, wrist pin (i.e., little end) crosshead and guides and big end. Very similar lubricators were fitted to the main bearings.



Eccentric setting

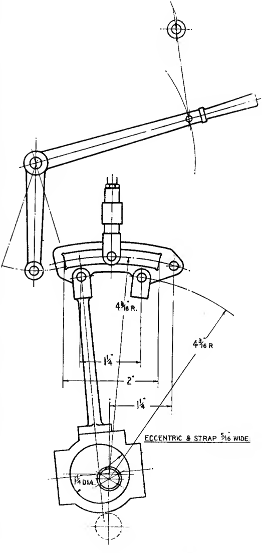


Fig. 8a. Link-motion, looking from crank

A splash guard was made and fixed inside the front column.

An oil catching race was made and fixed below the eccentrics, and this has a plug to allow it being drained.

A pattern was made for a solid disc type flywheel of heavy pattern, 5 in. diameter, and this flywheel replaced the original 7⅜ in. diameter one. The keyway in the crankshaft with which the latter was fixed was rather narrow, so in addition to a key, three 2-B.A. "Allen" grubscrews are fitted in the flywheel boss at 120 degrees on the inner side. In passing, the outer skin of the flywheel casting appeared to be some new combination of flint and diamond chippings, judging by its effect on high speed tools.

The cylinder lubricator is of the displacement type, with needle control valve, drain valve, and a separate coil condenser with a steam supply taken via a small screw down valve from the steamchest-cover, this is another built-up job, and is detailed in Fig. 8.

The sub-base was about the heaviest job of the lot, it is made from ½-in. steel plate and was cut out by saw and hole drilling methods, being finally filed to shape, using a heavy milling file for the roughing work, and losing about a stone in perspiration! It is detailed in Fig. 9.

A brass sump plate covers the crank-race in the sub-base, and a large bore pipe is brought from this to a position below the eccentric race for draining, the outer end of the pipe is fitted with a removable screwed plug.

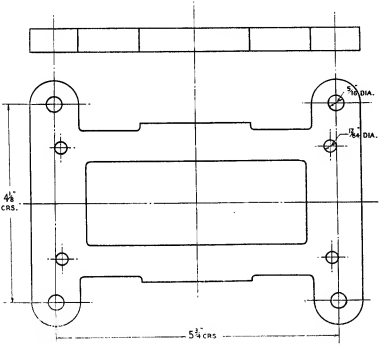


Fig. 9. Sub-baseplate

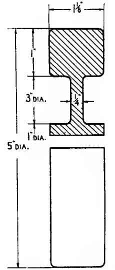


Fig 10. Flywheel m.c. all over

The question of fitting a boiler feed pump was considered, but turned down on several grounds, notably because the engine is intended for pretty high speeds, and though pumps can be designed and made to meet such conditions quite efficiently, they are apt to be noisy, and in any case in a plant of this size I prefer independent boiler feeding arrangements.

That just about covers the job except possibly as regards finish. Paintwork is green, except for the big end brasses, which, where not bright, are painted bright red.

All steel work is bright finished, as is the brasswork, but no attempt has been made to get a super polish, it would be quite out of place in such an engine.

The job has been a most interesting one, not only as regards the planning of the work, but the actual carrying out of it.

Stuart jobs are like good lathes, one has a sound foundation on which to superimpose additions and (one hopes) improvements.

The work was actually completed from start to finish in the spare time of six weeks, but there was quite a lot of spare time crowded into that period. There is probably well over 100 hours work involved, though I kept no record.

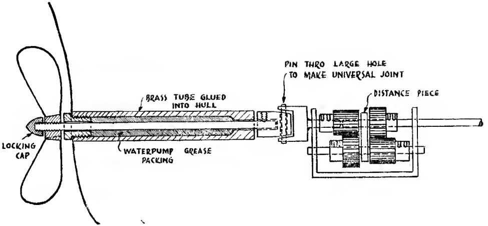


Fig. 9

*Beginning with "PEROMA"

By Colonel J. B. Adams

If it is necessary to centralise the rudder, the small lever L is used ; it will be seen from the diagram that a pull in the direction of the arrow will tend to centralise lever C, whichever side it happens to be. This lever is attached to the armatures of the switches S1 and S2 shown in Fig. 8, so that by using the appropriate one the rudder is straightened, S1 when on power, S2 when sailing.

Wireless Control

I do not propose to describe the transmitter and receiver in detail, since there is nothing in them of particular interest, and they were made up from scrap parts. A three-valve crystal-controlled transmitter is used tuned to 3,885 Kc/sec., and the receiver is a five-valve superhet with local oscillator, also crystal controlled. The anode load of the final valve is provided by the windings of the relay A (Fig. 3), which is operated by an increase of anode current of 0.8 m.a. or more. A received signal of 200 micro volts is sufficient to provide this and a range of some 500 yards can easily be obtained. This range is more than sufficient, since beyond about 150 yards it is difficult to see what the boat is doing.

I realise that the frequency I am using is not one allowed for such purposes by the G.P.O. and would therefore have to redesign the set if I ever brought the boat home.

I have built the transmitting key into a small control box which has a display panel lit by a series of torch bulbs. These are controlled by a rotary switch similar to the one in the boat, which

* *Continued from page* 60, " *M.E.*," *January* 9, 1947.

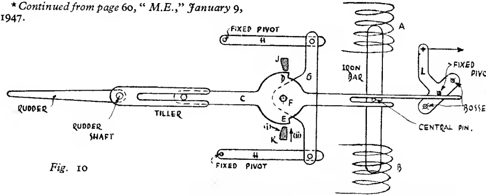
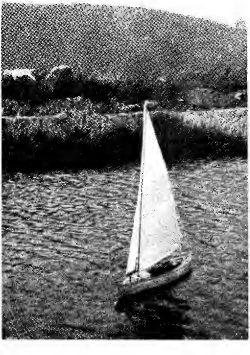


Fig. 10



"Peroma" close hauled in a light breeze, having just come about

steps round each time a signal is sent, thus indicating how the switch in the boat is set at any moment.

Trials (and Tribulations)

In early spring, the big moment arrived when I could fill my bath and see if "Peroma" would float the right way up. Much to my delight she did, and almost exactly on the designed waterline, though at this stage the wireless receiver was not completed and lumps of lead took its place.

In my innocence I had assumed that a coat of red lead, a coat of paint, and a coat of varnish would render the hull waterproof. That first trial in the bath taught me a lot, though when I first took the boat out and placed her on a stand I was not unduly worried by a little water inside the hull. However, ominous creakings soon started, and when my back was turned the rudder fell off; on investigation, I found that the distance between its upper and lower supports had increased by over ¼ in.! What had happened, of course, was that the water had got at the ply wood, which had swollen, and in addition the glue used in making it was not waterproof, with the result that before long daylight was visible through the hull in many places.

At first I thought I was defeated, but after allowing the hull to dry out thoroughly (without, incidentally, shrinking back to normal), I inserted a number of screws and nails in various places and fixed a wire from a bowden cable between the bottom and top layers and tightened it with a tourniquet until the whole thing was fairly firm again. I also poured a lot of glue inside and ran it into all the cracks.

I realised that unless I got hold of special paints that might or might not exist, I would not be able to keep the water away from the wood, and so decided to put some sort of waterproof cover all over the hull. As I was already in the bathroom, the bathroom curtain seemed to be the obvious solution, as it was a light sort of oilcloth and had seen better days, anyway. It turned out a great success; I cut it up into carefully-shaped strips and glued it on, using the same Casco glue as I'd used for the hull. I gave each strip a slight overlap on the next, which was hardly noticeable when the final coat of paint and varnish had been applied. She is now completely waterproof.

The next trouble that I noticed was that the slightest touch on the mast heeled her considerably—I believe "tender" is the correct term in sailing circles. This was obviously because the centre of gravity was too high, and in view of the size and weight of the batteries, I could not lower it. About this time, however, I first became acquainted with THE MODEL ENGINEER and found, amongst the advertisements, miniature alkaline accumulators for sale. I therefore sent home for three of these (Nife dW13), which duly arrived by registered post and my problem was solved. These, besides being very much smaller than my original ones, weighed only 24 oz., as opposed to 6 lb., so that I was now able to add a lead keel. The cells were uncased, so I made a container for them from talc and Scotch tape.

Fitting the lead keel was another problem. Having finally made the hull waterproof, I did not want to start cutting bits out of the bottom and did not know how to calculate the size and position of the lead to be inserted. So to avoid further research, I decided to melt the lead and pour it into the bottom of the boat. I got hold of some old lead piping, cut it up into convenient pieces, and melted them in a cigarette tin on the gas stove. Then, with my heart in my mouth, I poured a little into the bottom of the boat, hoping it would not burn its way through the wood. Fortunately, it didn't, so in went the rest, to give me an internal ballast right at the bottom, some 4½ lb. of lead. She is now quite "firm," and will stand a surprisingly stiff breeze.

Launching and Sailing

On June 1st, 1946, "Peroma" was officially launched and named. For the occasion, I had built a slipway into a local swimming pool, and the ceremony was performed by an A.T.S. officer, who broke a miniature bottle of champagne on her bows and cut a string to allow her to slide down into the water. All went well, but the champagne bottle had previously caused me much thought. I had tried to make one out of candle-wax, but it kept melting at the wrong moment. Also a medicine bottle is surprisingly tough, and would certainly break the boat rather than itself. In the end I found a small round bottle and, using a glass cutter, broke it into three or four pieces. I then held the pieces together and covered the whole thing with melted wax,

Mainsails beginning to divide as "Peroma" is turned down wind

filled it with champagne, corked it, painted it, and wrapped a piece of gold paper from its real big brother round the top. The final result was very good.

The wireless side was still not ready, but I subsequently did a series of sailing trials in a nearby gravel pit, and it was then that I discovered the need to move the sail-plan forward and fit the booms. Her first trial with wireless was not a great success, as various internal faults developed, but now at last she is complete and working, and I can honestly say that I have achieved, after many ups and downs, what I set out to do. I am not satisfied with the steering, which is difficult in a strong breeze, and still hope to fit a small motor when I can find a suitable one.

Conclusion

I would be the last to claim that "Peroma" is an exhibition model; she is definitely rough and ready, and there is no question of "scale model" about her, but she has taught me a great deal and started me off on an absorbing hobby—and she works! I have written about her in the hope that she may prove of interest to others and perhaps furnish a few ideas, but above all in the hope that her story will help to put me in touch with those who know so much more about these things than I do, and perhaps one day help me to get an introduction to a model engineering club where I can aim at better things. I already feel that I have learnt enough to be able to make another but very much better boat on the same lines.

In view of my opening remarks in this article, perhaps a list of some of the components of which "Peroma" is made would be of interest.

Notice boards used at the Potsdam conference.
A windscreen wiper.
Parts of German wireless sets.
A couple of trembler bells.
A lampshade.
A bathroom curtain.
An old sheet.
Some lead piping.
Talc from an old map case.
Two beads from a child's necklace.

And lots of string, glue, wire, odd bits of metal, plastic wood and paper clips.

Postscript

I have also made a small dinghy, which "Peroma" tows behind her and releases on command. The dinghy then anchors itself and raises a mast with a painted ping-pong ball on top to form a "mark on the course." But that is another story.

The Imperial War Museum

THERE is much to interest even the most tepid model engineer at the recently re-opened Imperial War Museum, Lambeth Road, London, S.E.1. Among the many fine models to be found there is a collection of waterline models, to a fairly large scale, of naval and assault craft, used in the 1939-1945 war, also with representative models to form a contrast of equivalent vessels in the 1914-18 war. There is a collection of modern military aircraft models mostly to 1/72 scale, and the 1914-18 period is represented by fully detailed models to a much larger scale.

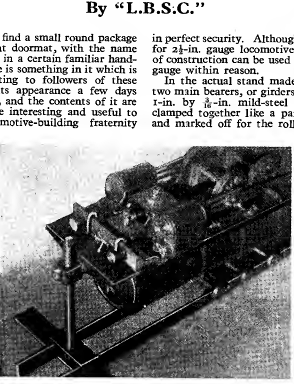
One model that will be almost certain to evoke interest is the experimental fort on floats, which was a projected design for the invasion of 1944. Those models depicting the Thames Estuary fortifications are also most interesting. As might be expected, one finds representative models of mechanical transport of both wars.

With regard to the full-size exhibits, it is difficult to quote any particular item for special mention, except, perhaps, the Spitfire Mk.1, serial No. R6915, of 609 Squadron, and the German V.2 rocket, which still impresses with its size, despite several viewings at various exhibitions. The German one-man submarine is also of great interest.

The collection of paintings by war-time artists of both periods are worth anybody's time to visit. The Museum will be greatly expanded as soon as the necessary work can be put in hand to house the exhibits.

A Testing Stand
for Small Locomotives
By "L.B.S.C."

WHENEVER I find a small round package on our front doormat, with the name and address in a certain familiar handwriting, I know there is something in it which is going to be interesting to followers of these notes. One made its appearance a few days ago, time of writing, and the contents of it are certainly going to be interesting and useful to those of the locomotive-building fraternity whose trackage space is limited, and also to those who prefer having a substantial support for the engine when making adjustments or repairs when upside down. The usual practice of turning the engine over, and supporting it by anything handy on the bench, is all right as far as it goes; but accidents *will* happen on the best of regulated benches! Incidentally, I keep a pair of felt-lined wood chocks especially for this purpose, and if I want to do anything to the "works" of an engine without taking anything apart, it is turned over and laid on its back with the boiler resting in the recesses in the chocks. It cannot slip, or sustain damage in any way.



An easy way of getting at "the works"

Mr. Edward Adams, who needs no introduction to our readers, recently built a two-cylinder version of my 4-12-2 four-cylinder "Caterpillar" goods engine. You all know what the weather has been like just recently; some folk reckon that when the atom bomb went off under water at Bikini, it blew about half the Pacific Ocean into the sky, and it is only just coming down again. Be that as it may, the fact remains that something akin to a complete diving outfit is needed to operate an outdoor railway these fine [?] days; and as our architect friend wanted to do a bit of testing, he applied his well-known versatility to designing a test stand for that purpose, which could be used indoors. The idea is, of course, as old as the proverbial hills; but the actual construction is original, simple, and ingenious, inasmuch as it combines the actual testing stand with a device for turning the engine over, and holding it upside down, or at any angle, in perfect security. Although primarily intended for $2\frac{1}{2}$-in. gauge locomotives, the same method of construction can be used to suit others of any gauge within reason.

In the actual stand made by our friend, the two main bearers, or girders, are 3-ft. lengths of 1-in. by $\frac{3}{16}$-in. mild-steel bar, and were first clamped together like a pair of engine frames, and marked off for the roller axles and spacer bolts. The holes for the roller axles were drilled and reamed to take $\frac{1}{4}$-in. mild-steel axles, and the metal above sawn and filed away, converting the holes into U-slots. The holes for the spacer bolts, which are ahead of and behind the "friction wheelbase," were drilled $\frac{1}{4}$-in. clearing. The bearers were then parted, and a couple of tube spacers 2 in. long, placed opposite the bolt holes. Ordinary $\frac{1}{4}$-in. bolts passing through both bearers and spacers, maintain the two bearers parallel and rigid at a distance of 2-in. between.

Rollers and Axles

The rollers, or friction wheels, are of brass, 1 in. diameter, the even dimension being chosen because this makes it easy to calculate the revolution of speed of the driving wheels, if a speed indic tor or revolution counter is applied to one of the roller axles. The rollers are $\frac{1}{2}$ in. wide, and are rounded off on their inner edges, to clear the radius at the root of the wheel flanges on the engine. In the present instance they are screwed to the axles; but if preferred, they can be pressed on in the same manner as the engine wheels are fitted. No axleboxes or other special bearings are used; the axles merely run at the bottom of the U-slots in the bearers. Should it be desired to add a flywheel, or any other means of providing an artificial load for any engine using the stand, one or more of the axles can easily be extended outside the rollers for this purpose, as is done on the full-sized stand at the Swindon "locomotive factory," as the railwaymen call it.

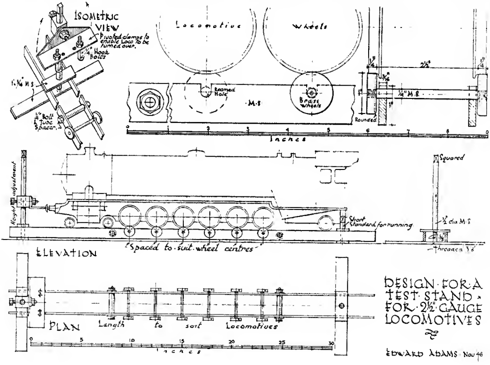
End Supports

The two base-plates on which the main girders rest, are 10-in. lengths of the same section bar as the bearers themselves, viz., 1 in. by $\frac{3}{16}$ in.; the clamp bars above are also of same section. The latter are only 3 in. long, and have $\frac{3}{8}$-in. clearing holes drilled in the middle. The base-plates are tapped $\frac{3}{8}$ in. The pillars are 9-in. lengths of $\frac{1}{2}$ in. diameter round mild-steel. The upper ends are squared, to take a spanner; the lower ends are turned down to $\frac{3}{8}$ in. diameter for $1\frac{3}{8}$ in. length, put through the clearing hole in the clamp plate, and screwed into the tapped hole in the base-plate, thus gripping the main bearers tightly between the two; a "column of mutual support," in a manner of speaking. Each column carries a small block of 1-in. square steel, drilled $\frac{1}{2}$-in. clearing, so that it can slide freely up and down. In one side of the block, is a $\frac{3}{8}$-in. set-screw; in the other, a stud and nut. This carries a piece of steel angle, same as we use for buffer beams; but the vertical member is filed away each side, as shown in the illustration, and drilled in the middle to accommodate the stud. Four $\frac{1}{4}$-in. clearing holes are drilled close to the edge of the horizontal member, in two pairs, to allow for variation in position of angles and so forth, under different engines' buffer beams. These holes are for two $\frac{1}{4}$-in. hook-bolts made from round mild-steel; they are clearly shown in the isometric view, and also in use in the photograph which shows Mr. Adams's "Caterpillar" upside down.

In addition to the two 9-in. pillars, which are used normally when testing an engine alone, a short one is provided, for use when running an engine on the stand, with the tender coupled up. This needs no explanation, and can be seen in place, in the outline illustration of the 4-12-2 on the stand.

"Operation Slippery Dick"

To use the stand, the supporting angles on the pillars are placed with the hook bolts hanging down, and the engine buffer and drag beams placed in the hooks. When the nuts are tightened, the beams are firmly held to the underside of the angles. The engine is then placed with the driving wheels exactly over the rollers, and the supports locked in position by turning the tops of the pillars with a spanner. The engine is lowered on to the rollers until the axleboxes are in running position; the set-screws in the height adjusting blocks, and the clamp nuts for the engine, are then tightened up, and the engine can be steamed up as though she were on the road. Quite a lot of interesting testing could be done, if one of the extended axles carried a pulley belted to a small dynamo, coupled to a set of accumulators *via* the usual cut-out, switch, and ammeter. The lighting equipment off an old car, which could probably be obtained at a reasonable figure from a car-breaker's yard, would serve this purpose very well. As a matter of fact, I have an old C.A.V. dynamo in first-class order, and the necessary equipment, having long since had in mind, rigging up a "power output tester" to confound some of the "calculation brigade" who are forever firing sackloads of their everlasting figures at my devoted head, and trying to prove by those same figures, that my locomotives



have nothing like the power claimed, and that it is "all a wangle." Everybody who has built a real "live steamer" to the instructions given in these notes, knows that I usually *under-estimate* the power developed, instead of exaggerating; but all the same, I'd dearly love to shoot back with a few actual figures obtained from a proper "scientific" test, and hoist the gentry mentioned with their own petard! Never mind, don't worry, old Curly hasn't forgotten! It is only because there is so much to do, and so little time left to do it in ("do it in" sounds a bit sinister!) that the plant hasn't been erected and put to the use mentioned.

However, returning to Mr. Adams's stand, if the engine has to be turned over for any purpose, all that has to be done, is to slack the set-screws in the adjusting blocks, lift the engine clear of the rollers, and tighten the set-screws again. If the nuts holding the pieces of angle to the studs, are slacked off, the whole issue can be turned over, and locked in any position by tightening the nuts again. The photograph reproduced here, shows the Adams "Caterpillar" on her back, supported by the angles as above. Incidentally, note the size of her cylinders; that item alone would have raised an awful moan from practically the whole of my old opponents. A $2\frac{1}{2}$-in. gauge boiler steam cylinders that size? Utterly impossible! I guess they know better now; and thereby hangs a tale. It's worth telling, and exemplifies the old saying about the proof of the pudding being in the eating.

Time Proves All Things!

You've heard me speak of my old friend "the Colonel," who lives up in Cumberland. When he left the "Kate Carney" after the first outburst of mass insanity, he started up as a chicken farmer. Unofficial history doesn't tell us whether he drilled the coopies, made them march in line and keep step, "form fours" and all the rest of it; but they didn't need any order to "come to the cookhouse door, boys," when he appeared on the scene with the needful at feeding time! However, the Colonel missed his vocation. Parental authority "directed" him to Sandhurst, whereas his proper destination was the nearest L.N.W.R. locomotive shed. Army life never killed his ambition to become an engine-driver; and as he couldn't handle regulator, brake valve, and reverser on a full-sized L.N.W.R. engine, he decided to have a small one of his own. He kicked off with the usual glorified toyshop outfit, tin coaches, poison-gas firing, and other impedimenta, but yearned for a *real* engine; so he got in touch with the then recognised expert of the period. The "Claughton" 4-6-0's had by then appeared on the L.N.W.R., and the Colonel wanted a little one, four cylinders and all complete. "Absolutely impossible," said the expert. "Two cylinders, then?" said the Colonel. "Useless," said the expert. The firebox was too shallow, and anyway a "scale" boiler would never steam them. The expert advised a 4-4-0 of the "George the Fifth" type, with an oversize boiler. The Colonel, knowing no better at the time, took his word for gospel and ordered the engine from a firm now defunct. He was goodness-only-knows-how-long getting delivery, and even when he *did* get it, it was a failure, mainly owing to the "patent" valve gear fitted in place of the correct Joy gear. The latter was eventually fitted, and the performance improved; but still the engine was nothing to write home about until your humble servant made the Colonel's acquaintance through this journal, and eventually fitted new cylinders about twice the capacity of the originals, which were ridiculously small.

But the Colonel still hankered after a "Claughton." The first time he visited me we had a confidential chinwag, and he told me all about his conversation with the expert. Did I think, in view of my experience, that a little four-cylinder "Claughton" with a "scale" boiler was feasible I said, unhesitatingly, that it was; and the way his face lighted up, was just nobody's business. I got no peace after that; would I build him a "Claughton"? I made a half-promise, "circumstances permitting," but unfortunately circumstances didn't permit. *Anno Domini* takes its toll; the spirit may be willing, but the flesh is weak. Writing, drawing, the huge volume of correspondence (which I'm afraid will soon have to take a back seat) leaves me but little time for my own experimental work. "Jeanie Deans" took fully four times as long as I anticipated. Anyway, in the end, the job of building the "Claughton" was given to Dick Simmonds and Fred Stone, the latter doing most of the work, on the understanding that she was to be built as near as possible to L.N.W.R. practice, but embodying "Live Steam" specifications.

The engine was duly completed, the Colonel naming her "North Western," after his favourite line, which he said was "murdered by Act of Parliament, on January 1st, 1923." If anybody wants to do what my young niece used to call in her schooldays, "get his wild up," you've only to murmur "L.M.S." The locomotive was duly delivered, but there were a few points about her that were not quite L.N.W.R. enough for the Colonel's liking, so he returned her for adjustments to be made. These were carried out by Fred Stone; and as it was the Colonel's wish that I should have a drive on her on my own road, last Friday morning (time of writing) Fred telephoned to ask if he should bring her over, as the sun was making one of his rare appearances, just to let folk know there still was such a thing. Old Sol seems as shy as young Curly was, nowadays! I said O.K., and about 2.30 p.m. a "flivver" meandered up the alley-way leading to the tin shed which houses my gasoline cart, and deposited Fred and the engine alongside the Polar Route. I'd already got out the electric blower, test car and other essentials, in case Jupiter Pluvius took over Old Sol's late turn, so we were able to get up steam right away; and in about four minutes she was "blowing off and ready for the fray," as the old poem puts it.

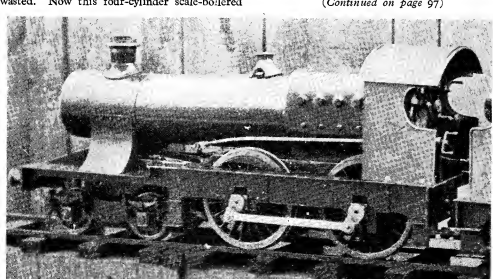
Fred made up a decent fire, and started off. Except for the bogie wheels coming off the road at a low joint—some of Jupiter Pluvius's antics—he did a virtual non-stop run of eleven laps

before the fire went down. Then Curly had a go. My old L.N.W.R. 4-4-2 tank "Olga" can do eighteen laps on one firing, and I thought I'd see if the "Claughton" could beat that on the same amount of fuel; so I slung in four shovelfuls, and started off with a black fire, low pressure, and not much water. She soon picked up, and by judicious use of the firehole door and the feed by-pass valve, I didn't waste any steam out of the safety valves; and, apart from emulating Fred in coming off the road at the low joint (she was travelling pretty fast, at that) the engine did eighteen laps ($\frac{7}{8}$ of an actual mile) non-stop on the four shovelfuls of coal. Pressure only fell on the last three laps; before that it was a job to keep her from ramping off skyhigh. Fred was a locomotive fireman until he slipped when holding a point lever, and the engine cut his foot off; his father is still a driver on the Southern. His comment was, "Curly, I'd have liked to have seen you on a big 'un—*they know you*!" Of course they do; that's just it. I've been told ever so many times that I'm not a human being at all, just a locomotive in human form (we *all* are, if it comes to that; but not in the way implied!) However, be that as it may, they won't be able to re-use my wheel centres and other serviceable oddments when I make my last journey to the scrap heap!

Ah well! As I headed this little dissertation, "Time proves all things." The expert of 20 years ago said that a "Claughton" type locomotive with a "scale" boiler and even two cylinders, was an "impossibility," which just shows exactly how much he really knew about it. Experience is, and always will be, the best teacher. You have to build engines yourself, from A to Z, and try out your own ideas, adopting the good, and ruthlessly scrapping the bad, before even attempting to claim any degree of expertness. Personally, if I don't learn something fresh from every job, I reckon it is partly wasted. Now this four-cylinder scale-boilered "Claughton" did the "impossible" with ease. She would have covered well over the mile, thus doing better still, with higher superheat. The boiler was made after the style that I specified some years ago for "Princess Marina," having two superheater flues. "Marina" only has two cylinders. But I did some experimenting after that, and found that, if the lubrication is beyond suspicion (it is, if you fit a good mechanical lubricator), you can't have the steam too hot on a little engine. The hottest I ever tried, was with an oil-fired water-tube boiler having a coil directly in the blow-lamp flame, and this was bright red all the time the engine was in steam. She was only 2½-in. gauge, and the tender held less than a quart of water, but she would run 3¼ miles without a stop, hauling my weight. If the "Claughton" referred to above, had been furnished with a four-element superheater with big flues and elements, she would have covered well over the mile on the one firing, "upside down and backwards" as the kiddies would say with emphasis. You will have noticed that I specified four superheater flues in the "Lassie's" boiler. The new "Castles" on the G.W.R. have high superheat and mechanical lubrication—something the "King" class could well have done with—and good as the original "Castles" were, drivers tell me that the new ones are a wonderful improvement. No wonder Swindon doesn't build Pacifics! The two engines I am building now, "Bantam Cock" and old "Grosvenor" (both 3½-in. gauge) will use mighty hot steam, with, of course, mechanical lubrication. I wonder what big "Grosvenor" would have done, with the same refinements? Gee-whiz—with all the accent on the "whiz!"

Like other folk who believe in using discretion, I'd never go tearing over the road just for the sake of mere speed; but there are times when it is policy to get a move on. Wouldn't

(*Continued on page* 97)



Mr. W. G. Palmer's composite G.W. engine

A FISHERMAN'S FLY-VICE

By MORLEY HEDLEY

FISHING-FLIES appear to be getting scarce and also expensive, and many anglers who hitherto used commercial flies are now beginning to make their own. Trout hooks are very tiny to hold in the fingers while attaching flies and have a nasty habit of pricking. The vice seen in the accompanying photograph and drawing was designed and made to hold fishing hooks of the smaller sizes while flies are being fixed.

Used in this way, it would be called a fisherman's fly-vice; but, with a little thought and a variety of chuck-jaws, it could be put to many other uses. As a pin-vice it leaves two hands free, and it would be very useful to a jeweller or watchmaker for holding very small parts when silver-soldering, brazing or soft-soldering. Readers might think of many other uses to suit their individual needs.

By slackening the knurled nut on the base, the vice can be swung round through 360 degrees and locked in any position. By slackening the knurled screw at the knuckle joint, the chuck-arm can be rotated in a vertical plane through rather more than 180 degrees and locked in any position. Similarly, by slackening the knurled nut on the chuck-arm, the chuck-jaws can be rotated through 360 degrees.

The vice in the photograph is made of silver-steel, with the exception of the base, which is duralumin. The question of material these days is often governed by what is immediately to hand, but there is plenty of silver-steel on the market. Whatever material is chosen for the stand, the vice-jaws should be made of hardened and tempered steel.

Lathework

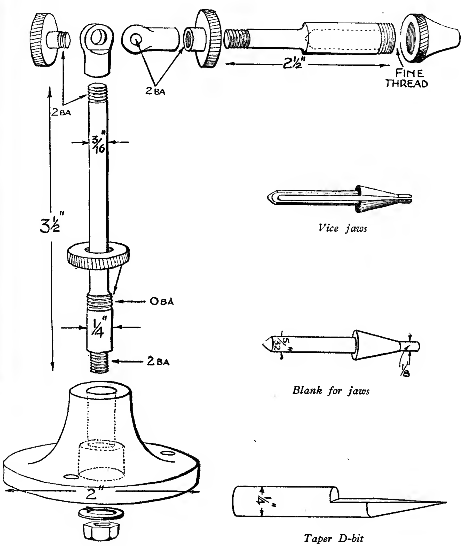
With the exception of finishing the jaws and knuckle-joint, the vice is made entirely in the lathe, and, to readers accustomed to using a lathe, the drawing will be self-explanatory. For the benefit of those readers with a lathe but no experience, a brief description of the sequence of operations will be given.

The Base

In the three-jaw, chuck a piece of the selected metal 2 in. diameter and leave a good inch protruding. True it up, face it, centre it and drill it 1 in. deep, with a ¼-in. drill. Then rough-turn the radius and finish with a file. It can then be polished to whatever finish is desired and sawn off. Then chuck a piece of ⅝-in. brass rod and turn a spigot on it so that the part-finished base is a nice fit with gentle tapping. The base should run true and can be faced off and counter-bored to accommodate a 2-B.A. nut and washer. While the base is on the mandrel, a line is scribed with a pointed tool and divided into three, using a marked change-wheel. This gives even positions for the screw-holes to fix the vice to a bench. The base can then be removed from the mandrel and the fixing holes drilled.

The Upright Arm

Chuck a piece of ¼-in. diameter steel and turn down a length of about ¼ in. to $\frac{3}{16}$ in. diameter and, with a tailstock die-holder, screw it 2-B.A. Screw on a nut and washer, unchuck and slide on the base. Scribe a line on the rod to show its position in the base. Re-chuck the rod the other way round, centre it and hold in the chuck so that the scribed line is clear of the jaws, and support the free end with the tailstock. Turn down to $\frac{3}{16}$ in. diameter to within $\frac{3}{16}$ in. of the scribed line. Cut off to length, screw ¼ in. of the end 2-B.A. and the ¼-in. part 0-B.A. or ¼ in. B.S.F. just past the scribed line. After polishing, this part is finished.



Vice jaws

Blank for jaws

Taper D-bit

The Chuck Arm

This is a piece of $\frac{5}{16}$-in. steel, turned down to $\frac{3}{16}$ in. for a length of about $1\frac{1}{2}$ in. and screwed 2-B.A. for $\frac{1}{2}$ in. It is then reversed in the chuck and sawn off, leaving $1\frac{1}{8}$ in. at $\frac{5}{16}$ in. diameter. It is then centred and drilled $\frac{3}{16}$ in. to a depth of 1 in. The end is next screwed with the finest thread for which taps and dies are available. In this case $\frac{5}{16}$ in. $\times$ 40 t.p.i. was used.

Knuckle-joint

The joint was next made out of $\frac{3}{8}$-in. diameter steel turned down to $\frac{1}{4}$ in. for about $\frac{1}{2}$ in. long, drilled No. 25 and tapped 2-B.A. The rod is then sawn off, leaving sufficient length to file up the ends. Two of these are required and, after they are filed to shape, one is drilled and tapped 2-B.A. and the other drilled $\frac{3}{16}$ in. To make a neat job of the filing, silver-steel buttons can be made and hardened, and when they are placed one in each side of the hole, the end can be filed to a true circle.

Knurled Nuts

Two knurled nuts are now required, and they are turned from $\frac{5}{8}$-in. diameter stock and parted off $\frac{1}{8}$ in. thick. The one for the base is tapped 0-B.A. or $\frac{1}{4}$ in. B.S.F., according to which thread was put on the upright arm. The other is tapped 2-B.A., and it is advisable to leave a small neck on this nut to keep it clear of the knurled screw.

(*Continued on next page*)

SELF-CONTAINED VEE ROPE DRIVE FOR A 3-in. TO 4-in. LATHE

MANY designs have been prepared for the vee rope drives for small lathes, and the following is a typical arrangement developed for a $3\frac{3}{4}$-in. lathe. Having available a 1/3 h.p. motor, it was desired to incorporate a drive integral with the lathe, and at the same time maintaining simplicity in design. The drawing on the opposite page shows the design finally decided upon.

It will be seen that the main part is a casting (1) This swing plate, which is made in aluminium, carries the motor and the countershaft. Adjustment between the motor pulley and countershaft pulley is provided for by means of slots in the swing plate for the motor securing-bolts. This is standard practice. The countershaft (2) is a length of $\frac{5}{8}$-in. diameter silver-steel running in "Oilite" bushes (3). No lubrication is necessary since the countershaft is only 500 r.p.m. The bushes are a press fit in the swing plate and secured by small grub-screws down the ends of the bush, half in the swing plate, and half in the bush itself. In order to reduce vibration to a minimum, the swing plate is carried from a bracket (4) on the lathe bench. To tension the belt for the cone pulleys, the swing plate is connected to the lathe bed by means of a slotted link (5). This is pivoted on a bracket (6) on the bed and locked to (1) by a stud and handwheel (7). This has the advantage of correcting any error in pulley centres, due to unequal cone pulley diameters. The belt on the cones is always initially due to the eccentrically loaded swing plate, therefore the slotted link is primarily to maintain rigidity between the cone pulleys.

A FISHERMAN'S FLY-VICE

(Continued from previous page)

The knurled screw is made the same size and screwed 2-B.A. The knurling, of course, is done before they are parted off.

The Jaws

When making the jaws, it is advisable to turn a few blanks, as they can be finished afterwards to the shape required without having to find the correct angle of the taper. The blank is made from $\frac{1}{4}$-in. diameter silver-steel, and a length of 1 in. turned down to 5/32 in. This reduced portion is held in the chuck and sawn off, leaving about $\frac{1}{2}$ in. at $\frac{1}{4}$-in. diameter. The top slide is then set to turn a taper of rather less than 30 degrees. The jaw blank is then finished as shown in the drawing.

Without altering the angular setting of the top slide, a piece of $\frac{1}{4}$-in. silver-steel rod is chucked and tapered to a point. This is to make a taper reamer to bore the chuck at the same angle as the jaws. Rather more (just a few thous.) than half the diameter is then filed away, thus making a taper "D" bit. It is then hardened and tempered.

Chuck

The jaw blanks can be conveniently left until the chuck is made. This is made from $\frac{1}{2}$-in. diameter silver-steel. The blank is faced off, centred and drilled $\frac{1}{8}$ in. to a depth of at least 1 in. This hole is then opened out to a depth of $\frac{3}{8}$ in. to the diameter of the tapping size of the thread put on the chuck arm. It can then be tapped to the bottom. Holding the taper "D" bit in the tailstock chuck, the taper is then gently turned out till the larger end is $\frac{1}{4}$ in. diameter. The jaw blanks can be tried for fit and the length of the chuck marked, and, after knurling, can be sawn off. A piece of $\frac{5}{16}$-in. brass rod is then chucked and screwed the same thread as the chuck. This is a mandrel on which to finish the chuck. The chuck is screwed on and turned to a neat contour and polished.

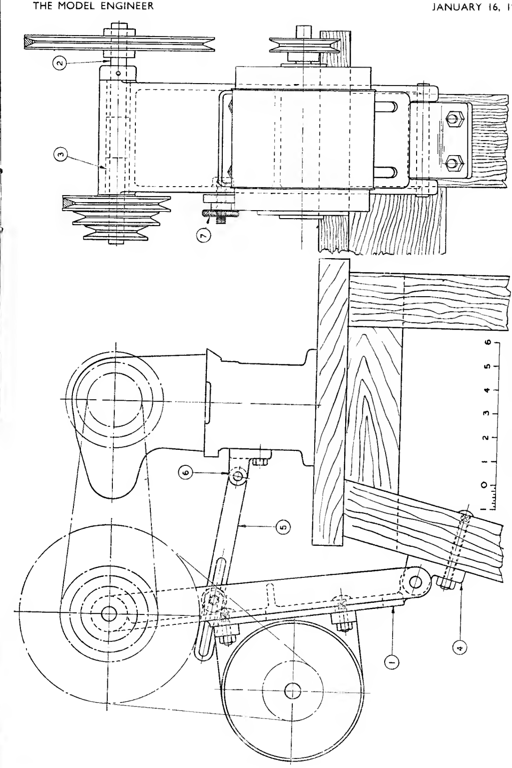
Finishing Jaws

A variety of jaw shapes can be made from the blanks; but the simple two-jaw is made by filing a good flat on each side of the stem and slitting down the middle with a jeweller's piercing-saw. This allows the jaws to spring open to insert a needle-file to open them out, but leave about $\frac{1}{8}$ in. of the actual jaws untouched. The jaw ends are then hardened and tempered.

Hardening and Tempering

The taper "D" bit and the jaw ends must be hardened and tempered, and as the jaws are so small, the cone will be hardened also. It is best to leave the spring portion of the jaws in the natural state, as silver-steel has sufficient natural spring.

The silver-steel is heated to a bright red and quenched in sperm oil. If no sperm oil is available a good substitute is a tablespoonful of common salt in a cupful of warm water. The steel is then repolished bright and gently warmed until the bright surface assumes a pale straw colour. This operation is rather difficult with tapering parts as the thinner portions heat up first. A little practice makes for efficiency, however; and if the steel is heated on a sand tray, it will heat up evenly. The steel first turns pale straw, graduates to dark straw then through a range of blues to black, when most of its hardness will be lost.

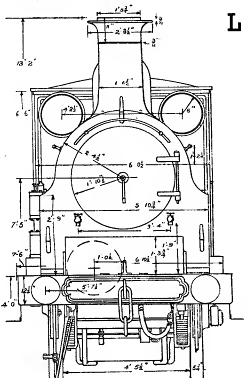


Details, in two views, of a self-contained vee rope drive for a small lathe

LOCOMOTIVES WORT

by F. C. Haml

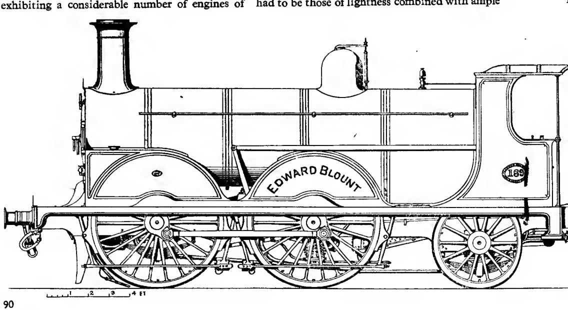
No. 20—L.B.S.C. Railway, "E



Many would say "the loveliest engine ever"—and maybe they would be right!

THE Paris Exhibition of 1889 caused no small stir in the locomotive world. The Continental railways seized this opportunity by exhibiting a considerable number of engines of various types, and even three of the English companies considered it worth while to go to the expense of send ng examples of their workmanship across the Channel. Yet, of these, only one of the major lines felt attracted to indulge in such publicity; the Midland Railway d.spatching a brand new single-wheeler, No. 1853. Very attractive she looked in her superbly fin:shed red paint and her owners were repaid by the fact that she gained the senior award—the Grand Prix. The other two entrants belonged, very naturally, to the railways d.rectly concerned with the cross-Channel Continental traffic.

The South Eastern Co. contributed their new Stirl:ng 4-4-0, No. 240, whilst the L.B.S.C. Railway, mindful of the effect a gorgeous yellow engine would make on those who ventured across the waters to see the great exhibition, selected the brand new *Edward Blount*—the latest example of the already famous Gladstone class. But not all those fortunate ones who gazed at No. 189 would be aware of the intense care and thought that had been bestowed, not only on the design in general, but on every little elegant detail of the beautiful engine. Yet care and thought were not enough to make her the masterp:ece she undoubtedly was. A masterpiece embod:es those touches of genius, which her designer, Mr. William Stroudley, happ:ly possessed in marked degree, and his eng ne was the product of all three qualities. The general layout was as unusual as it was clever. Mr. Stroudley's first considerations had to be those of lightness combined with ample



WORTH MODELLING

. Hambleton

Railway, "Edward Blount"

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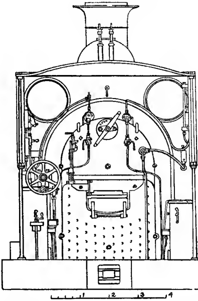
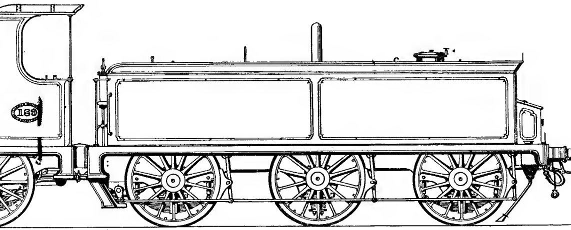
adhesive power and a short wheelbase. To gain these qualities he placed his coupled axle at the front where the heaviest parts (cylinders, motion, pumps, etc.) could bear on the leading axle. (Incidentally, the greater length of flange of the big 6 ft. 6 in. wheel below rail level, gave a bigger margin of safety for the leading wheels.) The trailing wheels could be placed as far back towards the rear as needs be to accommodate a long and deep firebox, yet without unduly spreading the wheelbase. This appealed to the enginemen, since it was a far nicer thing to stand over a carrying wheel than over a coupled axle with all its stresses and pounding. The centre pair of springs were given more flexibility than the other two sets, so that the running of the engine approximated to a four-wheeled vehicle. The spring loads of the two coupled axles were equal, the centre of gravity of the engine was high and well forward, and the draw-bar of the tender swung radially, as though pivoted exactly under the centre of gravity. The boiler and firebox were in harmonious balance; indeed, they could be lifted by a single sling hooked on just behind the dome, and the balancing of the motion, and the cranks (the latter by extensions of the crank hoops) was well-nigh perfect. When running *Edward Blount* glided as though floating on a lake! The slide-valves were placed below the cylinders, so that they barely rested on their port faces when the engine was coasting. Having disposed of the large steamchest in this easy manner, it was possible to bring the big cylinders (18½ by



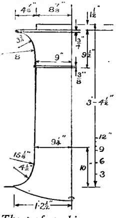
A wonderfully neat cab layout. The interior was yellow, with white roof, firebox by stays black, and panel above door-tray olive green

26 in.) as close together as 25 in. centre to centre (these were in one cylinder-block—a fine piece of casting). This gave lots of room for thick cranks, long journals, and wide eccentrics. Mr. Stroudley, after watching drivers work their engines, found that they preferred induced draught to forced draught, so he provided a rear damper only to the big ashpan. In addition to this only a portion of the exhaust went up the chimney, for much of it branched off into the tender to heat up the feedwater. *Edward Blount* had a very gentle

No. 189 was the engine-driver's dream come true—delightful to handle and very fair to look on



puff-puff, yet there was plenty of draught in her big 6-ft. firebox, though not enough for a Brock's Benefit Display at the top of her handsome chimney! The tender, likewise, was designed with the greatest of care. Its tank was surrounded by a hot-air jacket contained within cleading plates, to enable the feed to retain its high degree of temperature. The fireman could stand on its two tons of coal without risk of coming into violent contact with any overhead bridge. It was carried on six standard 4 ft. 6 in. carrying wheels, interchangeable with the other classes of Stroudley engines, and only weighed, when empty, 15 tons 7 cwt. The result of all this planning was that the Gladstones proved incredibly economical engines, as will be related in due course.



The perfect chimney—and how it matched the engine!

The cab was roomy and comfortable, with a splendidly clear lookout, all controls well within reach, and the hand closed gratefully on the various beautifully shaped handles. The equipment was most up-to-date, comprising sight-feed lubrication, steam lubrication to leading wheel flanges, air power-reversing, speed indicator steam sanding, and the provision of two water gauges (in lieu of the customary set of test-cocks) and their accompanying gauge lamps, electric passenger communication, and Westinghouse brake on both engine and tender. In short, No. 189 was the engine-driver's dream come true, delightful to handle, and very fair to look on.

So the golden summer days of the "Exposition" passed away, and in the autumn the French authorities suggested a series of trials between the engines. To this rather dubious proposition the Midland Railway Company sent a polite refusal. After all, there was not much to be said against the proposal The engines were quite unalike in type, they had hardly been run-in, there was the difficulty of the difference between the English and French rail-gauge, and in any case No. 1853 was wanted for immediate service at home. The other two companies, perhaps out of deference to their foreign neighbours, accepted the invitation Much of the trial line was set in order, the down road gauged to the normal 1.45 m., the up line being reduced to 1.44 metres. On December 17th No. 189 ran her first heavy load trial. Coupled to 20 vehicles weighing 241 tons empty, she went from Paris to Laroche, 155 kilometres. A hot coupling-rod end prevented her from making the return trip. Mr. Stroudley took a bad chill, but insisted on attending the trials, although far from well. Two days later, No. 240 performed her double journey with the same load. Meanwhile, Mr. Stroudley developed a sharp attack of asthma, and to everyone's consternation, he died the next day, December 20th. Nothing more was done until the new year, when, on Jan. 15th, No. 240 did her final heavy load trip, followed by *Edward Blount's* a week later, representatives of the Government and officials of the French Railways being present on both occasions. On the outward journey the S.E.R. engine lost 7 min. and homewards 10 min. on the scheduled time; while the L.B.S.C. locomotive kept exact time outwards and dropped 8 min. returning. On balance, she appeared the better engine. The difference in consumption of coal briquettes was remarkable. No. 240 burnt 1,950 kilos, and 1,782 on the return; whereas No. 189 used only 1,697 out and 1,581 home—a total difference of 454 kilogrammes! The high speed trials had meanwhile been begun. Both engines had a tryout on January 17th, when they ran from Monterau to Sens and back, a total of 68 k., coupled to a small four-wheeled saloon weighing 11.39 tons empty. Next day they both had the high-speed finals, the various officials again observing the performances. The best speed of No. 240 was 121 k. per hr., that of No. 189 rising to 125 over the same route.

The Stirling ran stiffly on the outward journey but seemed more at home on the reduced gauge of the up line. No. 189 moved equally easily in both directions, and proved the faster engine. A last-minute proposal to help No. 240 was then made. Her coupling-rods were taken down, and she made yet another trip as a 4-2-2 engine. The unexpected happened. She never ran above 115 k. per h. except for a single kilo. at 117! But, apart from this general fall in speed, she ran quicker uphill than downhill! No doubt, once having gained momentum, her increased freedom resulted in fast uphill work; whereas downhill, her driving wheels may have bounced up from the rail surface, thus causing a curious, though well-known, form of slipping. In any case, the hasty expedient of removing her rods would upset the carefully calculated balancing of a four-coupled engine. So what? It makes one inclined to feel that such competitive trials are, at best, unsatisfactory affairs. And who, after all, wants to see two good pals engaged in personal combat Not a very edifying spectacle. I would rather remember them both doing their legitimate daily work for which they were designed, and doing it very excellently at that. Both were awarded gold medals, and both had lengthy and useful careers. The South Eastern engine long outlived her rival, although whether from inherent excellence, or due to Southern Railway locomotive policy is hard to say.

Useful Dimensions of *Edward Blount*

Cylinder inclination, 1 in $11\frac{1}{2}$. Ports, $1\frac{1}{2}$ and 2 by 15 in.

Slide-valve inclination (downwards), 1 in 15. Length of boiler barrel, 10 ft. 2in. Length of firebox shell, 6 ft. 8 in.

Grate area, 20.65 sq. ft. Overhang of front frame, 5 ft. 10 in.

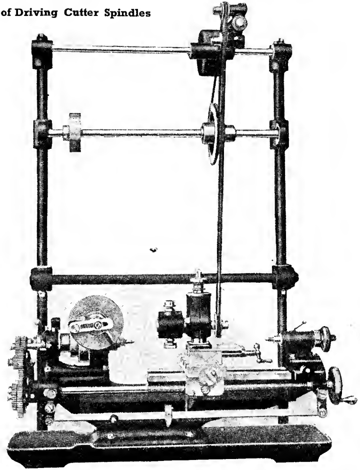
Leading to driving wheels, 7 ft. 7 in. Driving to trailing wheels, 8 ft. 0 in. Rear overhang, 4 ft. 4 in. Wheelbase of tender (equally divided), 14 ft. 0 in. Total length of engine and tender, 51 ft. 10 in. Front overhang of tender, 4 ft. 2 in.; rear overhang, 4 ft. 2 in.

*MILLING IN THE LATHE By "NED"

Section 5.—Means of Driving Cutter Spindles

A general review of the principles, appliances and methods employed for adapting the lathe for various types of milling operations

A TYPICAL example of the form of overhead gear supplied by lathe manufacturers as accessory equipment for the lathe is shown herewith. This attachment was formerly produced by Messrs. Drummond Bros. Ltd., for use on their 3½-in. "M" type lathe, and will be seen to resemble the appliances already described in its general essentials. The vertical frame is built up of steel tubes, with cast lugs at the junctions, and the overhead shaft runs on ball races. Only one speed is provided for the countershaft drive and also the drive to the cutter spindle, though the specification mentions a three-step pulley for the latter. The tension lever has the counterweight directly attached to the rear end, and the jockey pulleys are mounted on separate shafts, one above the other, which allows of more exact belt alignment than when the pulleys run side by side. Endwise adjustment of the drive is provided for by shifting the drive pulley on its splined shaft, and sliding the tension lever along the top bar of the frame.



Drummond 3½-in. "M" type bench lathe, with dividing attachment cutter spindle, and overhead gear in position

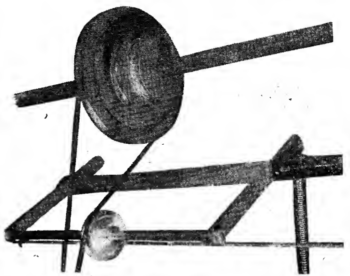
Other interesting features of this equipment include an ingenious form of milling head, mounted on the top slide, incorporating a cylindrical vertical slide, with micrometer index, and a skew-geared cutter spindle, which is universally adjustable for angle, and reversible end to end. A worm indexing appliance is attached to the lathe headstock (further details of appliances of this nature will be given in the next section). It should be clearly understood that this milling attachment is no longer available from the makers; it is illustrated here purely for the information of readers who wish to construct or adapt similar fittings for their own lathes.

Mention has already been made of using a power countershaft or overhead lineshaft to drive a cutter spindle. While this has definite limitations, as compared to a properly arranged overhead gear, it has been used very successfully for driving the cutter spindle illustrated in Fig. 38 (page 504, November 21st issue), in conjunction with the simple belt-tensioning device shown in the next photograph, also in Fig. 44. This consists of a light swinging frame, carried on pivots in two brackets mounted below the lathe countershaft, and having a single jockey pulley running and floating endwise freely on a cross shaft, so that it can find its own alignment with the drive pulley, which may be shifted on the countershaft, and locked in any position with

*Continued from page 28, "M.E.," January 2, 1947.

a set-screw. A long tension spring, anchored below the bracket, maintains an upward pressure on the jockey pulley.

This arrangement of the jockey pulley is only suitable for use with large diameter driving pulleys, and at best can only take up a limited amount of slack in the belt. It will, however, cope with a cross-traversing movement of the cutter spindle sufficient for most of the usual milling operations dealt with in a small lathe. By using a doubled-back belt arrangement over two jockey pulleys, a considerable variation of belt length can be compensated, but it should be remembered that even with almost frictionless jockey pulleys, a good deal of power is absorbed in bending the belt over them. The simplest pulley arrangement is always the most efficient, and is recommended particularly where driving power is limited.



Belt tensioning device fitted to countershaft, as in Fig. 44

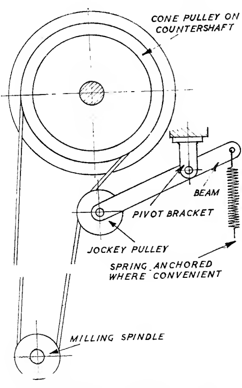


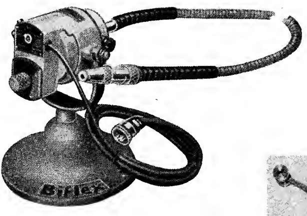
Fig. 44. Simple belt tensioning device for driving cutter spindle from power countershaft

Flexible Shaft Drive

Several users of milling attachments have succeeded in driving them successfully by means of a flexible shaft, coupled either to the lathe countershaft or any other convenient source of power. This avoids the limitations of belt drive in respect of angle or position of the cutter spindle, and also enables a greater torque to be transmitted than is possible with most forms to light driving belts. Various types of flexible shafts have been used, including dental drill shafts, speedometer and aircraft engine tachometer drives, and the heavier flexible shafts designed for driving rotary files, grinding wheels etc. In one case, the flexible shaft of an old horse-clipping machine has been thus adapted.

It is advisable to run a flexible shaft within the range of speed and torque for which it was originally designed, or trouble may be caused, either by overheating due to friction at high speed, or failure of the strands of the cable through torque overload. Speed changes are best made by altering the gearing at the cutter spindle end, so that the flexible shaft may run always at a constant speed. Some speedometer drives are designed to work only in a left-hand direction, and will not stand reversal; the only thing to do in this case is to gear the cutter spindle, either by spur, bevel or skew gearing, so that it runs in the reverse direction to the flexible shaft. The power absorbed by some forms of flexible shafts renders them rather unsuited to use where power is limited, such as on treadle lathes.

The form of cutter spindle may need to be modified where flexible shaft drive is used. In most cases the shaft coupling is enclosed within a kind of union joint, so that when the outer cable is connected to the housing of the driven member, the inner shaft is automatically coupled by a square and socket, or spline. Similar arrangements are also provided at the other end of the shaft. It is often possible to adapt the driving gear of a



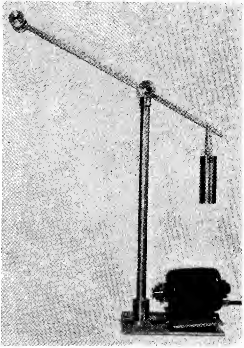
The "Biflex" flexible-shaft driving unit

speedometer, consisting of an enclosed right-angle shew or bevel gearing, to transmit the drive from the lineshaft or countershaft.

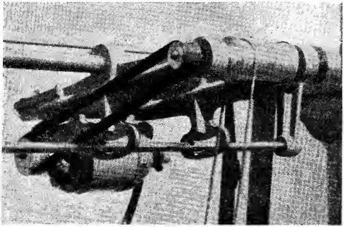
An example of a flexible-shaft appliance which can be adapted for milling in the lathe is the "Morrisflex" equipment illustrated herewith. This is manufactured by Messrs. B. O. Morris Ltd., and comprises a portable driving motor, with flexible shaft, and a handpiece with chuck to hold rotary files and cutters. The latter can be adapted for mounting on the lathe tool-post or vertical slide to serve as a cutter spindle. In the particular appliance illustrated, known as the "Biflex," a 1/3 h.p. motor is provided, and this will furnish ample power for any operations likely to be encountered in the amateur workshop. Strictly speaking, a self-contained power unit of this nature should be classed under the heading of "motorised" attachments, to be described below.

"Motorised" Drive

The attachment of an electric motor directly to the milling appliance is quite a practical proposition, though it does not appear to have yet been done, so far as can be ascertained. It is, however, very common in modern grinding attachments, and very compact and powerful electric motors have been developed for this purpose. Such a motor, permanently attached and suitably geared to a cutter spindle, would supply all the power required, and could be used at any angle or position.



Motor driving unit for cutter spindle, by Mr. K. N. Harris



Motorised overhead gear, by Messrs. Bontor and Marshall

A possibility which has occurred to many lathe users is the mounting of an electric drill on the lathe for milling purposes, and the only snag in this scheme is that the spindle of a light machine of this type is not usually designed to deal with side thrust as encountered in milling operations.

The use of a separate motor, mounted in a convenient position to drive a cutter spindle in the lathe, is, however, fairly common nowadays as a substitute for the orthodox overhead gear, and may be found more adaptable than the latter

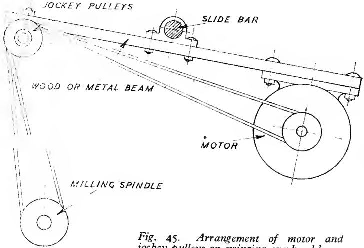


Fig. 45. *Arrangement of motor and jockey pulleys on swinging overhead beam*

of two aluminium castings located some distance apart, carrying the motor mount at the rear end, and a ball-bearing countershaft at the other (Fig. 46). The centre housing of each beam is bored to a sliding fit on a supporting bar, which is mounted at each end in cast aluminium brackets carried by an angle-iron frame above the lathe bed (Fig. 47). Swinging movement of the beam assembly is limited by slotted lugs on the beam castings, which encompass a bar passing between vertical extensions of the end supporting brackets.

The motor has driving pulleys of different sizes

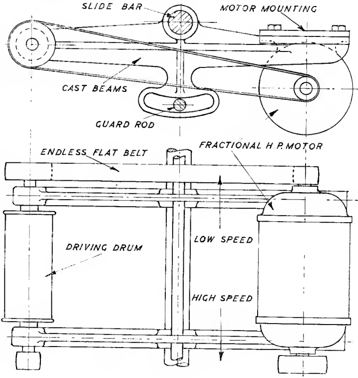


Fig. 46. *Elevation and underside plan of motorised overhead gear*

for certain kinds of work. Mr. K. N. Harris uses a driving unit comprising a baseboard on which is mounted an electric motor, and a vertical pillar carrying a tension lever with jockey pulleys, as shown. The motor is bolted to a hinged base-plate, with adjusting screws which enable either of the three steps of the cone pulley to be aligned with the jockey pulleys on the centre pillar. An appliance of this kind can be placed in any position, to suit the location of the milling spindle, and will usually stay in place with its own weight, or, if not, may be temporarily held by light clamps, or a couple of screws.

Mr. F. G. Arkell uses an electric motor attached to the rear end of a beam, similar to the tension lever of the orthodox overhead gear, adjustable along a bar mounted over the lathe, the motor in this case serving as a counterweight to maintain tension on the belt, which runs over jockey pulleys on the front end of the beam (Fig. 45).

A rather more elaborate development of this idea is incorporated in the driving gear constructed by Messrs. F. Bontor and R. C. Marshall. In this case the beam is duplicated, and consists at the two ends, the countershaft being similarly equipped, so that two speeds of the latter are obtainable, the drive being by means of an endless flat fabric belt. Tension adjustment can be obtained by sliding the driving motor backwards or forwards. The centre part of the countershaft is occupied by a drum or roller,

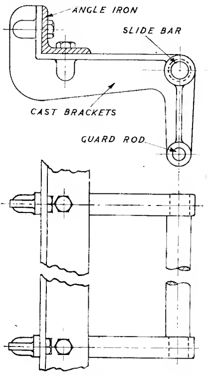


Fig. 47. Support brackets for motorised overhead gear

which forms the drive pulley to the milling or grinding spindle mounted on the lathe slide-rest. This provides a fairly wide range of self-alignment, but a cone pulley would be equally suitable, as it is only necessary to slide the complete unit on its supporting bar to line up the drive at any position along the lathe bed.

Questions are often asked as to the power of the motor required for driving a cutter spindle in this way. This will naturally vary with the class of work being dealt with, but it may be mentioned that most of the work done in small lathes, using the appliances which have been described, can be handled with a motor of about 1/10 or $\frac{1}{8}$ h.p. Indeed, it would be found difficult to transmit more power than this by the light belt drives specified. Grinding attachments are in a different category, but here it is possible to transmit greater power by running at higher speed.

A Correction

A reader has pointed out that in the drawings of the simple cutter frame (Fig. 34, page 501, of the November 21st issue), the collar on the cutter spindle prevents assembly of the lower location-adjusting nut for the worm wheel. Apologies are due to readers for this slip, but it is pointed out that a slight modification to the spindle would enable it to be corrected. The collar could be made loose, or its diameter reduced to the core size of the threaded part, so that the nut would slip over it. Adjusting nuts above and below the worm wheel are desirable, to enable it to be centred accurately in relation to the worm, without affecting the height of the cutter or the setting of the pivot screws; but the design of this simple appliance will probably be modified, in any case, to suit the requirements of individual constructors.

(To be continued)

"L.B.S.C."

(Continued from page 85)

old Curly dearly love to start away from Waterloo with a hotted-up "Grosvenor" hauling six Pullmans on Timken bearings, and show the Southern "biscuit-boxes" exactly the right and proper way to run the "Bournemouth Belle!" I know what that engine could do, with her modest 150 lb. of wet steam. I'll say that beyond Wimbledon, about all the staff and passengers at wayside stations would see, would be the front of the smokebox (with luck) a blurred streak of yellow and chocolate, and—if it wasn't raining!—a cloud of ballast dust and flying bits of paper. Happy dreams! Well, the fiat has now gone forth that the steam locomotive is to be banished for ever, from my old line, and its next-door neighbour, the old South Eastern and Chatham; but there is one consolation. When every goods and passenger train passing our hacienda, is operated by the step-sisters "Milly Amp" and "Diesel," there will still be a little unelectrified and unnationalised railway close by, over which real steam locomotives of the "Brighton," "Nor-west," and other railways of bygone days, will still puff merrily along with living loads, until such time as Curly quits this benighted planet.

In conclusion, I hope those good folk who clamour for something in the old "Live Steam" strain, have been entertained and amused by the above. Regarding Mr. Adams's "Caterpillar," as soon as he gets some pictures of her, I hope to offer them with a few particulars. The other picture shown, illustrates another "composite" job, a G.W.R. "City" type in $3\frac{1}{2}$-in. gauge, after first test. She embodies an "Iris" boiler, cylinders and motion of "Miss Ten-to-Eight," and various blobs and gadgets off other engines described in these notes; and was built by a Notts. reader, Mr. W. G. Palmer. Won't he catch it from Inspector Meticulous for putting a G.W.R. driver on the left-hand side of the cab!!

Measuring Horse Power

By "Arty"

— Some Methods Suitable for Model Engineering —

"J.W.H." has recently given an excellent article on measuring horse-power from a practical aspect, and largely concerning but one type of brake. This present article outlines, rather from more theoretical aspects, some other methods of measuring torque, and hence, horse-power, that are suitable for application to model engineering.

As an introduction, here is a quotation from "The Steam Engine," by John Farey, 1827 :—

"The only unequivocal mode of expressing the mechanical power exerted by an engine . . .

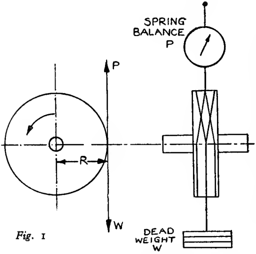


Fig. 1

is the weight which can be raised through a certain space in a given time by that exertion; and unless we define what a horse-power is in those terms, it is a very vague expression, on account of various degrees of strength which different horses possess, and their capacity on enduring fatigue.

"When Messrs. Boulton and Watt first began to introduce their rotative steam engines into manufactories, about 1784, they found it necessary to adopt some measure of the power which they were required to exert; this they endeavoured to do in such terms as would be readily understood by the persons who were likely to want such engines. The machinery in the great breweries and distilleries in London was then moved by the strength of horses, and the proprietors of these establishments, who were first to require Mr. Watt's engines, always enquired what number of horses an intended engine would be equal to.

"In consequence, Mr. Watt made some experiments on the strong horses employed by the brewers in London and found that a horse of that kind, walking at a rate of two and a half miles per hour, could draw 150 pound avoirdupois by means of a rope passing over a pulley so as to raise up that weight, with vertical motion, at the rate of 220 feet per minute.

"This exertion of mechanical power is equal to 33,000 pounds raised vertically through a space of one foot in one minute, and he denominated it a horse-power, to serve for the measure of the power exerted by his steam engines . . ."

Needless to say, this is quite a robust horse!

Generally speaking, there are two types of dynamometers :—

(*a*) Absorption. This type absorbs and dissipates the energy.

(*b*) Transmission. This type measures the power while being transmitted to where it will perform useful work. It is usually taken to mean measuring the power transmitted by a shaft, belting, etc.

Absorption Dynamometers

(*a*) *Crane*

One of the simplest methods is to use the power of the engine under test to wind a weight up. This gives the power directly in foot pounds per minute (33,000 ft. lb. per minute being 1 horse-power) with very little losses to be allowed for. There are two items to be noted :—

(1) The weight must be lifted at a constant speed. This is very important.

(2) Allowance must be made for the weight of the rope or, better, use a continuous rope which will balance out and obviate the necessity.

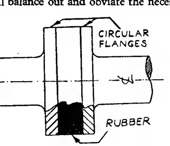


Fig. 2

(*b*) *Pony Brake*

"J.W.H." has discoursed very ably on this subject, and it is not proposed to cover this class of brake here. It should be pointed out, however, that the brake gear itself, without any weights, should be in static balance, otherwise a false figure for the horse-power will be obtained.

(*c*) *Rope Brake*

In this form of brake (Fig. 1), two (or more)

ropes are placed round the rim of a pulley and spaced evenly across it by means of three or four wooden spacer blocks.

The torque $= (W - P) R$

and the horse-power $= \dfrac{2 \pi N (W - P) R}{33{,}000}$

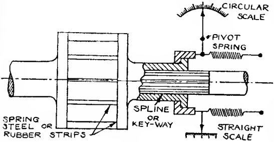


Fig. 3

Where W = Dead weight in pounds.
P = Spring balance load in pounds.
R = Effective radius of W. & P. in feet.
N = R.P.M. of pulley.
$\pi = 3.142$.

W. P. and R. need not be in these units for the actual test (ounces and inches would probably be more appropriate) but the test figures would have to be converted to these units before being substituted in the formulae given. These remarks apply throughout this article.

Some practical items :—

(1) P is normally measured by a spring balance, while W is usually actual weights. This ensures an equilibrium system. (A spring balance may be easily constructed by taking a suitable spring, hanging various known weights on it and noting the deflection. A scale may then be made up to suit the experimental calibration. Of course, it would be easier to surreptitiously appropriate a specimen from the kitchen!)

(2) There should be some stops to prevent the dead weight W from proceeding too far from its static position and assuming too high a velocity! When a reading of the horse-power is being taken, the weights W should be floating between the stops, of course.

(3) The pulley rim should be sufficiently smooth to obviate the possibility of the ropes binding or snatching.

(*d*) *Air Brake*

This is simple to construct, consisting of almost any suitable size and number of fans, paddles or blades, flat or curved, revolving in air or any liquid. It is not so convenient to use, because calculating the horse-power is a little complicated, and it is usual to calibrate a brake of this nature by a series of experiments which may involve difficulties, especially if a suitable range of known horse-powers is not available. The adjustment of the power absorbed is by altering the operating radius, size or number of the blades, the first method being the most convenient and generally used. There are two further disadvantages in this method in that the brake load cannot be adjusted while running and that the blades may be susceptible to engine impulses leading to dangerous vibrations. It would probably be as well to position oneself other than in the plane of rotation of the blades, anyway!

Transmission Dynamometers

These are very interesting and useful types, as the horse-power developed may be measured while the engine is performing its normal duty.

(*a*) *Torsion Dynamometers*

When power is transmitted along a shaft, the driving end twists through a small angle relative to the driven end. This angle of twist has a simple relation to the torque transmitted, but is usually extremely small and consequently difficult to measure. Both optical and mechanical means can be used, but none are altogether satisfactory, and would be less so for small horse-powers.

It is possible for the shaft to oscillate about its axis if the frequency of the engine's impulses coincides with the natural frequency of the shaft, and this may fracture the shaft, or, in its milder form, render torque deflection measurements difficult. It is assumed here that the shaft is purposely made on the weak side, so as to allow for as large an angle of twist as possible.

A method of overcoming these difficulties is to use a stiff shaft with a short section allowing a large deflection. One way of doing this would be to incorporate a rubber-bonded coupling, Fig. 2, in the shaft. This would have a white line painted on it parallel to the shaft under

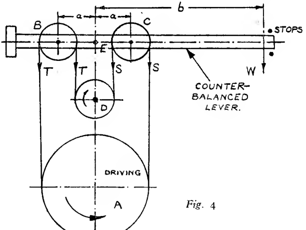
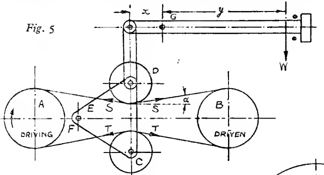


Fig. 4

no-load conditions, which would deflect when the coupling was transmitting power. The deflection would be observed by stroboscopic means, either by a separate instrument or by a cover attached to the coupling with a slot cut in it such as to allow observation of the mark. The mark

would thus only be visible to the observer at one point during each revolution of the shaft, and a built-in automatically synchronised stroboscopic effect would be obtained. The deflection would be calibrated against torque transmitted by static tests employing an arm clamped on the shaft, from which weights would be hung. (The arm by itself would be balanced, of course.) The disadvantage attached to this method is that rubber-bonded couplings are not a commodity that everyone can obtain.

It may be possible, however, to utilise an arrangement such as shown in Fig. 3. As the torque transmitted increases, one flange moves closer to the other along the splines and acting against the springs. A pointer attached to the spring would move over a fixed straight scale, or, acting through a pivot, over a circular scale, the latter method, allowing a measure of magnification of the deflection, being preferable. The



scale would be calibrated by static tests much as before.

(b) End Thrust Measurement

In an arrangement such as a pair of single helical gears transmitting power, the end thrust is proportional to the torque transmitted, allowing of a similar device to that shown in Fig. 3 to be used. The torque may be arrived at by experimental calibration or from a theoretical aspect as follows. The force transmitted by the gears has a component acting along the axis. If the angle between the axis and the slope of the teeth be " a " and " P " the pressure between the teeth, then the force tending to move the gear axially along the shaft is P tan a, assuming ideal conditions. This force is measured, enabling P, and hence the horse-power, to be determined.

(c) Belt Transmission Dynamometers

These measure the difference in tension between the tight and the slack side of a belt while transmitting power. There are two common methods of doing this.

As shown in Fig. 4, the belt, cord or string passes from the driving pulley A, over the intermediate pulleys B and C, to the driven pulley D. The driving and driven pulleys revolve about fixed points, but the intermediate pulleys revolve on pins fixed to the lever pivoted about a fulcrum E, on a fixed frame. The total downward forces on the wheels B & C are 2T and 2S respectively, and the net anti-clockwise moment on the lever is $2(T - S)a$. This is balanced by the weight W on the lever acting at an effective radius of b.

Thus, $Wb = 2(T - S)a$

$$\therefore \quad T - S = \frac{Wb}{2a}$$

$$\text{The h.p.} = \frac{2 \pi N (T - S) R}{33{,}000}$$

where N is r.p.m. of wheel A.
T, S and W are in pounds.
a and b are in the same units (say ins.).
R is effective radius of wheel A in feet.
π is 3.142.

Another method is shown in Fig. 5, which, while not so simple, is more easily applied in most instances. Pulley A is driving pulley B, the belt passing over intermediate idler pulleys C and D in the meanwhile and being arranged with the driving or tight side at the bottom. The jockey pulleys ride loosely on pins fixed to a triangular frame E, which is free to turn about point F on the line of centres of the driving and driven pulleys A and B. The net downward force on the jockey pulleys caused by the difference in the belt tensions is transmitted to one end of the lever which pivots about a

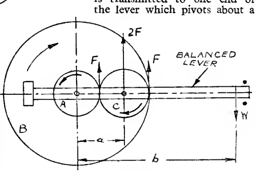


Fig. 6

fixed point G and is balanced by a dead weight W. The dynamometer is adjusted so that the lever floats mid-way between the stops when the jockey pulley centres are equidistant from the line of centres of the main pulleys A and B. The frame, jockey pulleys and lever should be balanced, with the belt removed, by a subsidiary weight.

The pulleys A and B should be the same size and the four straight portions of the belt equally inclined to their centre line at an angle " a."

Hence the total downward force on the idler pulleys due to the tension in the belts equals

$$2 (T - S) \sin a$$

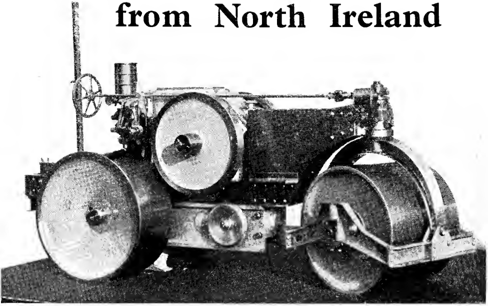
Considering the forces acting on the lever,

$$2 \times (T - S) \sin a = Wy$$

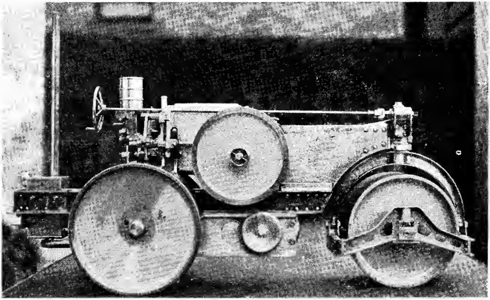
$$\therefore T - S = \frac{Wy}{2 \times \sin a}$$

(*Continued on page* 104)

An "M.E." Road Roller from North Ireland



The photographs show an unfinished example of the "M.E." Road Roller constructed by Mr. S. W. C. Coulter, of Belfast. It embodies several minor deviations from the original specification, including the use of chassis members bent from $\frac{1}{16}$-in. steel plate, steering-head fork and fore-carriage fabricated from steel, and ball-bearing jockey sprocket to primary chain drive, as described by Mr. Ian Bradley. Ignition is by miniature coil and Nife D.W. 13 accumulator. All machining with the exception of the road wheels, was carried out on a 4-in. Drummond lathe



MODERN METALS AND THEIR USES

By John Wilson, B.Sc.(Eng.), A.M.I.Mech.E.

METALS have assumed great importance in the last few years, so much so that it is perhaps timely to fix our ideas with regard to them. The need for knowledge of metals and their possibilities today and to-morrow is still great, particularly amongst those engaged in engineering. Many reports have been issued from time to time by professional bodies[1] and while much of the information is academic, a great deal of it is practical in its outlook. This article is concerned with the latter aspect of metals, as gained from experience and from the volume of evidence on the subject.[2] Present tendencies are favourable to the use of alloys, both ferrous and non-ferrous. Elemental purity has been discarded, and strength, though still important, is offset against other properties. Does the metal withstand high temperatures, does it resist atmospheric and galvanic corrosions, and can it stand up to mechanical abuse? These are questions that arise nowadays. When answered by experience or research, two further questions are put, viz., can the metal be machined and can it be welded? For machining purposes, the hardness factor (*e.g.*, Brinell) must be known, so that in the absence of suitable cutting tools, new ones may be designed; and for welding operations, its resistance to oxidation and scaling, thermal expansion and ductility, are factors on which knowledge is essential.

Ferrous Metals. (1) Alloy Steels

Any metal containing iron is said to be ferrous, and when it also contains carbon it is commercially known as steel. Carbon is a non-metal, and its presence in the iron gives it strength, and this quality, of course, depends on the percentage of carbon in the metal. Strength alone, however, is not sufficient, hence the necessity for including in the steel other pre-determined elements to improve its physical or chemical properties. Such admixtures gives rise to the alloy-steel, which takes its name from the added substance, *e.g.*, tungsten-steel, nickel-steel, chromium-steel, and vanadium-steel, etc. The list of alloy-steels is manifold, and many combinations are got from manganese, cobalt, molybdenum and aluminium, and it is now proposed to refer to the effects produced by each of these.

When manganese is alloyed to steel it produces an exceedingly tough material, suitable for ordnance and shrapnel helmets. So tough is it that special tools made from tungsten and tungsten-cobalt are required to machine it.[3] Nowadays excellent results have been obtained from cutting tools of all kinds—it is a case of "diamond cut diamond"—and progress is largely due to the use made of electrical steel-tempering furnaces. There are few alloy-steels on the market but cannot be planed, turned, bored or drilled. As a rule, tungsten is a constituent of the tool-steel. Its nature allows of this, for it gives a material great hardness at high temperatures—a requisite of tools. In addition, tungsten-steel is eminently suitable for the exhaust valves of internal combustion engines, although many firms prefer an alloy containing both tungsten and chromium for this purpose. It is claimed that tungsten-chromium-steel can be subjected to a temperature of 1,450 deg. F. without deleterious effects.

Chromium itself, as obtained from chrome ironstone ($FeOCr\ O_3$), and lead chromate ($PbCrO_4$), is the best known of the elements for alloy-steel. It has long been known that the addition of chromium to steel renders it non-corrosive to atmosphere and to certain acids. If some 12 to 15 per cent. is present in an alloy, the material is said to be stainless, and as such is eminently suitable for impulse blading in turbine design.[4] In this form too, chromium-steel is used for general steam parts, feed pumps and water meters, and has, may it be noted, the necessary mechanical strength for these components. Another variety manufactured is employed for fittings on ships' decks, and is definitely resistant to a salt-laden atmosphere. Again, high-chromium steel containing probably 15 to 20 per cent. chrome and a small percentage of nickel can be forged and rolled at 1,800 to 1,900 deg. F., and further, it can be cast, machined, pressed and hammer welded. With these qualities, high chromium steel has possibilities as a structural medium.

From the general standpoint, stainless steel is at its best when highly polished, and kept free from bruises. If exposed with a broken surface such steel tends to rust, and deterioration is rapid. Components consequently should be handled with extreme care, whether they be domestic fittings, cooking utensils, golf clubs, or the exterior plates and handles of automobiles. That such a material as stainless steel gives strength combined with an attractive appearance cannot be denied. For this reason, the metal is likely to be more popular in the future than ever. Chromium is extensively used in the electro-plating industry, the process being that of electrolysis. Articles so plated are found to resist the corrosive effects of atmosphere, and so long as the chromium surface remains unbroken, these articles endure for a long time.

Classed with tungsten and chromium, we find molybdenum. This element imparts to steel a similar, but more intense effect than that of tungsten. And belonging to the iron group of metals, we find nickel and cobalt, both of which are the only magnetic substances (excluding iron itself), and naturally, both of these elements increase the magnetic properties of steel to which

1 E.g. The Institution of Mechanical Engineers, *cf.* Pearce, 1941. Proc., Vol. 146, No. 2, pp. 61-81.

2 *Cf.* Hesse, 1941. "Engineering Tools and Processes: A Study in Production Technique" (D. Van Nostrand Coy., New York).

3 *Cf.* Roebuck, 1938, Proc.I.Mech.E., Vol. 139, p. 531.

4 *Cf.* Cunard White Star *Queen Mary*, as built by Messrs. John Brown & Coy., Ltd., Clydebank.

they are alloyed. Nickel does more, it gives the steel greater stiffness, so much so that it can resist shearing stresses and strains as imposed on crankshafts, marine propeller shafts, and general components, such as axles and gearing. It is further a most suitable alloy-steel for marking-off tools, as pointed out by the writer in back issues of THE MODEL ENGINEER. Frequently too, connecting rods are manufactured from steel forgings containing nickel, or nickel and chromium, or even chrome-vanadium. Vanadium itself, by the addition of 0.3 per cent., intensifies the elasticity of steel. In consequence, the presence of vanadium in steel is most helpful for components taking shocks, *e.g.*, valve springs, front axles for automobiles, and the under-carriage mechanism for the modern aeroplane.

Finally, with regard to alloy-steels, no review of metals would be complete without a reference to aluminium, the most abundant metallic constituent of rock materials. Its extraction from the ores has been greatly cheapened by modern electrolytic methods. The minerals from which it is chiefly obtained are bauxite, found in France, Ireland and U.S.A., and cryolite, which is found in Greenland. The metal is extremely useful, in that it alloys readily with most of the elements. In the ferrous mixture—particularly with cast-steel—it has the effect of driving out occluded gases (the cause of "blown holes"), and of making the new material more homogeneous. Aluminium-steel is reputed to be second only to that of nickel-steel in strength. More is said of aluminium below, under "non-ferrous" metals, and so for the moment we leave it.

Ferrous Metals (2) Straight Steels

The modern preference for alloys has not ousted the irons containing carbon alone—the straight steels. The most important are: (1) mild-steel, and (2) hard steel. The former contains 0.1 to 0.4 per cent. carbon, and is extensively used in structural work, because it lends itself to easy shaping. Its ultimate strength lies between 25 and 40 tons per square inch. Unfortunately it corrodes in atmosphere, and when employed structurally, mild-steel requires regular coatings of paint to preserve it from the effects of rust. Ordinary tinplate is mild-steel coated with tin. The combination provides the protective qualities of tin with the strength and cheapness of iron. In this form, the material has an extensive use in the "canning industry," the coating of tin rendering it impervious to vegetable and fruit acids. Tin alone is too heavy and soft, hence tinplate, sold in various sizes and thicknesses, is preferred.[5] Lastly, mild-steel (M.S.) is employed in the making of templates, tubes, rods, bolts, nuts and rivets.[6] When used for cams, gudgeon-pins, and ball-races, mild-steel can be case-hardened. This makes it hard on the surface, and the process is done by heating it in contact with charcoal, leather and substances rich in carbon, the depth of the "hardness" being determined by the duration of the heating. For surface "hardness" ferrocyanide of potassium may be smeared on the mild-steel, to be followed by heating.

Iron in its purest form is known as wrought-iron (W.I.), although there is no such thing as pure iron. As such it is a laboratory novelty. Wrought-iron, soft, malleable, ductile, contains 0.02 to 0.08 per cent. of carbon, and it can be forged and hammer-welded. Its crystalline structure does not allow of its being hardened, although like mild-steel, the metal can be case-hardened. With a high melting-point, wrought-iron can be safely welded at 1,600 deg. F. One of its most important uses industrially, and in light engineering, is for cores in dynamos, motors, and transformers. Wrought-iron, too, makes good electro-magnets, although modern practice prefers a 4 per cent. silicon-iron alloy for electrical purposes.

It is difficult to differentiate between mild-steel and hard-steel. The former gradually merges into the latter (with 0.5 per cent. carbon, and over) to form a brittle variety of steel lacking in elasticity, but very suitable for cutting-tools. In brittleness, hard steel resembles cast-iron, about which much is already known. Certain features of cast-iron call for attention in this article, however, and will be briefly referred to. The metal is strong in compression, and when well cast (without "blown holes") it is first rate for components subjected to static thrusts. Cast-iron possesses, too, its characteristic properties up to red-heat, therefore it can withstand high-temperature conditions; the metal further softens before melting, therefore it can be welded, and finally, as a material for arduous working conditions, it can stand much wear and tear. Unfortunately, cast-iron corrodes easily, it lacks homogeneity (especially in large castings—and cast-steel is found to be more reliable), it is heavy and has a low-conducting heat power as compared, say, with aluminium (or its alloys) for pistons in automobile and aero-engines. Recent researches, nevertheless, have given the engineering industry martensitic[7] and austenitic[8] cast-irons, both of which are likely to be more generally suitable for high duty purposes. Up to the present, however, as far as the writer is aware, cast-iron, on account of its "springy" nature (strength in compression), has not been displaced in the manufacture of piston rings, although such components must be handled with care to prevent breakage of the highly brittle material.

Non-Ferrous Metals

In spite of the important commercial value of steel, there is also a significant use for other metals today, *e.g.*, aluminium, zinc, copper, tin and their alloys. Most people are more familiar with the alloys than the elements themselves, *viz.*, brass, soft solder, silver-solder, bronze. Brass—a copper-zinc alloy—has already been referred to in the columns of this journal[9], as also have soft-solder (tin-lead alloy) and silver or hard-solder (silver copper-zinc alloy). Other varieties of solder can be obtained from other

5 E.g. IXX (No. 1, Two Cross), or IXXX (No. 1, Three Cross); *cf.* Kay, "Sheet Metal Work" (Cassell & Co. Ltd., Ltd., London, etc.).
6 *Cf.* "Common Metallic Processes," by the Author, in THE MODEL ENGINEER.

7 After A. Martens, *cf.* Note 1.
8 After W. C. Roberts-Austen, *cf.* Note 1.
9 *Cf. Common Metallic Processes*, by the Author.

mixtures of non-ferrous metals, but since these are not likely to be generally used, and since space does not permit of our enlarging on them, no further comment is needed here. Like brass, bronze is also an alloy of copper, but the mixture is copper and tin instead of copper and zinc. Both brass and bronze cast well, and machine easily, although in good practice it is advisable to specialise the work in these metals. At one time, brass-finishing was a trade of its own, and those engaged on it were most jealous of their skill. Such tradesmen would tell you that the addition of lead to brass improves its machining properties, and the presence of tin gives it a better polishing surface.

Before dismissing the "bronzes," three more call for attention, *viz.*, gun-metal, the phosphor, and the manganese varieties. The first contains 90 per cent. copper and 10 per cent. tin, it makes strong castings, is tough, and has a high tensile strength; the second, by the addition of 1 per cent. phosphorus, is much stronger and eminently suitable for bushes and high duty bearings; and the third, manganese-bronze, usually contains zinc, as well as tin and manganese. It is tenacious, ductile and hard, and offers great resistance to sea-water, and as a result, the alloy is employed in the manufacture of ships' propellers, sea water pump components, bulkhead glands, etc.

There remains aluminium, zinc and lead. The last is exceptionally heavy, and is resistant to most acids, except nitric. It is an ingredient of soft-solder, and its oxides are to be found in paints, accumulator plates, and in glass. Zinc is less heavy, and is non-corrosive in the air. For this reason, iron and steel are improved by a coating of zinc, the result being the well-known galvanised iron. Of aluminium it may be said, it is the lightest useful constructional metal today. The metal (with its alloys) has an important application in aircraft structure, so much so, that until the advent of new materials for aeroplane fuselages, it dominated the designer's outlook. Of its alloys, duralumin, containing copper, manganese, magnesium (rather lighter than the base), and some silicon (a non-metal) is the best known. It possesses the property of self-hardening, a property quite different to those peculiar to alloy-steels. Whereas the latter require special heat treatments according to data set forth by British Standards Specifications, duralumin, after being heated to, say, 896 deg. F., does not attain its full strength (probably 28 tons per square inch) until three or four days later. During this time, the alloy can be shaped, then put aside to harden by itself.

The Rarer Metals

It is truly an age of alloys. Even the expensive metals like platinum, iridium, tantalum, palladium, and cerium have been harnessed to industry, either as bases, or in combination, for alloys. The applications are many, and can be read about in modern up-to-date chemistry text books. Two uses will suffice here. Platinum and iridium in the ratio of three to one make most satisfactory contact-pieces for magnetos, and according to a contemporary writer[10], the dies in the spinning jets of artificial-silk works are manufactured out of platinum alloys. Of platinum itself it is worth noting that it is not acted upon by air, water or strong acids at any temperature. The analysis of many minerals is not possible without the aid of platinum crucibles. Lastly, the metal (like iron) softens before melting so that it can be welded, and for the making of gas-tight joints with glass, it is unsurpassed.

10 Schofield, 1932, *The Scottish Educational Journal* (July 22nd), p. 908.

Measuring Horse Power

(*Continued from page* 100)

Where T, S and W are in pounds.
x and y are in the same units (ins.).
a is in degrees.

The h.p. is then determined as before.

(d) Epicyclic Train Dynamometer

As shown in Fig. 6, the spur wheel A is keyed to the driving shaft and revolves counter-clockwise; the internal wheel B is keyed to the driven shaft and revolves clockwise. The power is transmitted from A to B, *via* the intermediate wheel C, which revolves on a pin fixed to the lever pivoting freely about the common axis of the driving and driven shafts. Considering the ideal case, the tangential effort exerted by the wheel A on the wheel C and the tangential reaction of internal wheel B on wheel C are equal and both act upwards so that the total upward force on the lever through the axis of wheel C is 2F and the torque is 2Fa. This torque is balanced by the weight W acting at an effective radius "b," so that

$$2Fa = Wb$$

$$\text{Whence } F = \frac{Wb}{2a}$$

Where F and W are in pounds, and a and b are in the same units,

$$\text{the h.p.} = \frac{2\pi NFR}{33{,}000}$$

Where N is r.p.m. of wheel A.
R is effective radius of wheel A in feet.
π is 3.142.

The bevel wheel epicyclic is similar to this, but is omitted, as ordinary gears are easier to come by than bevel gears.

In conclusion, it should be pointed out that these notes are necessarily brief and incomplete, and are merely intended to outline some other methods of measuring the horse-power. No consideration is paid to determining the r.p.m., but this is considered outside the scope of this article.

As my last word, may I ask if "L.B.S.C." has ever had any experience of a dynamometer car or a locomotive test plant in model engineering?

A Light-Weight Engine

By J. H. JEPSON

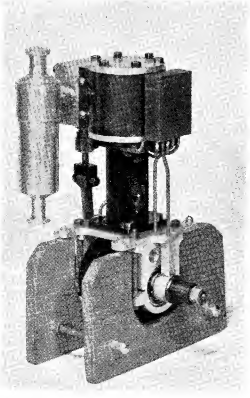
THE engine herewith illustrated is one of a pair, which comprise recent additions to a lengthy line of similar engines, which I have built over a period of twenty odd years. My first engine was made up from a set of Stuart Turner B.B. machined parts, and what a real job it proved to be; so much so, that it captured my model-making affections, and I still remain true to my love of engines of that type and size.

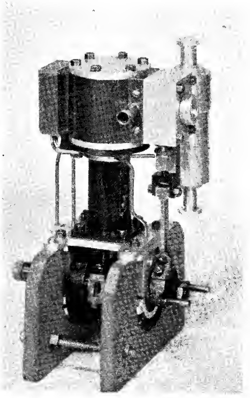
That will explain why I used S.T. cylinders in my design, though with slight modifications in cutting the ports, and especially the passages. The cylinder cover, steam-chest and cover are of anti-corrosive light alloy, somewhat similar to duralumin, but the piston and valve rods work in gunmetal glands. Gland nuts are secured by lock-nuts, a precaution bought of experience. The slide-valve and its nut are also of gunmetal, the nut being $\frac{5}{16}$ in. thick, tightened as much as possible. Most valve nuts are too thin, and this does not allow for many threads, consequently, after a period of work, such as my engines are called upon to do, the threads get very slack, and so upset the valve timing; the thicker nut eliminates this. Cast-iron is used for the piston, which is fitted with a $\frac{1}{16}$-in. ring. The column and trunk guide is of steel, and, in common with other steel parts, is blackened by burning several coatings of oil on them, the result being a nice shining black, rustless finish.

Crosshead and big-end bearings are of cast bronze, the latter, of course, being split. Here I may mention a method of big-end lubrication, which I have used for many years with complete success. One oil pipe feeds oil to the piston rod, first oiling the gland, which, incidentally, requires very infrequent taking up, despite really high revolutions and hot steam. The oil then passes into suitable holes in the crosshead, lubricating same, with small end pin, and then drips down the hollow connecting rod, and so to the big end. High revolutions make no difference, the oil really gets there.

The connecting-rod eccentric strap and sheave are of mild-steel, both the strap and sheave being case-hardened. Once run in and adjusted, they last indefinitely.

No flywheel proper is fitted, this being incorporated in the crank, which has webs $1\frac{5}{8}$ in. diameter and $\frac{5}{16}$ in. thick, with shafts of $\frac{1}{4}$-in. silver-steel, pinned through the webs and





silver-soldered. As ball-races are used, I thought it safer to pin the joints, in addition to silver-soldering, in case the shafts were pulled out by the nuts on ends of shafts.

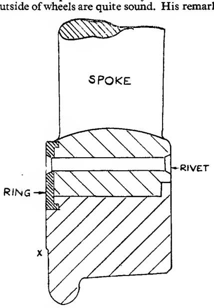
By slackening off one nut, the eccentric can be readily set, and does not move when the nut is tightened.

My friends often chip me about my liking for cutting things out of the solid, but my love of hand tools, files in particular, make this method a real labour of love to me. The oil-boxes are an example of this; I was unable to obtain any brass tube of the shape and size my fancy dictated, so I cut some from solid bar, having the nicks a full 1/32 in. and the ends $\frac{1}{16}$ in., soldering in the base and fitting $\frac{1}{16}$ in. pipes. In the illustration may be seen an oil pipe for an additional supply to the big end, but this is more of a fad, in view of the already satisfactory arrangement. One of this pair of engines has already had considerable use, but is still in perfect condition, the only items that have been altered is a new oil-box of about three times the capacity (not fabricated this time) but milled from a block of dulalumin, though it does not suit the engine for appearance, as did the original. Since building these engines, I have added to my score with a $\frac{5}{8}$-in. × $\frac{5}{8}$-in. launch engine, but that is another story.

Letters

Locomotive Wheels

DEAR SIR,—The comments upon model locomotive wheels on page 550 of THE MODEL ENGINEER for December 5th in an article by "One of the Judges" makes me wonder if that particular judge has, after all that "sound engineering training, wide experience," etc., which he would, from the article, have us believe. The remarks related to the representation of tyres on the front or outside of wheels are quite sound. His remarks



Relief at x on 8- *and* 10-*coupled engines*

on "simulating by suitable machinery on the back," however, are open to comment. He then shows a section of a G.W.R. locomotive wheel having Carlton's tyre fastening, introduced by S. Carlton, Locomotive Works Manager, Swindon, in 1874, and used by the G.W.R. ever since.

Other companies, however, do not use this method. The enclosed sketch shows the more general system in use. When this is done and the tyre shrunk on to the wheel centre and a cut taken over the back, the tyre can only be distinguished by a fine hair line. As most of my locomotives are fitted with real tyres and I did not exhibit at the Exhibition, I have no axe to grind.

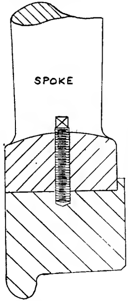
Yours faithfully,

Hertford. G. G. WOODCOCK.

Traction and Portable

DEAR SIR,—I read with both interest and enjoyment the article by Mr. G. Harrison in the issue of November 28th.

I would like to support most heartily his plea for the re-publication of some of the old designs in THE MODEL ENGINEER. A new generation of



Most common in use

model engineers has arisen "that knew not Saul" and it is a pity that they should be deprived of benefiting from some of the magnificent work of past contribution.

Greenly's large undertype (which, unless my

memory is at fault, formed the subject of the first *coloured* plate given by THE MODEL ENGINEER) was one of the best things ever published; incidentally, a model built to this design finds an honoured place in the Science Museum at South Kensington.

Budd's overtype was another excellent job, though I would like to see an alternative design for a coal-fired locomotive-type boiler included.

In Volume 13, 1905, was published a design with most complete drawings for a model horizontal mill engine with automatic cut-off valve gear; the arrangementof drawings, part-lists and the general set-up of the whole article was a model which could be studied with advantage in these more casual times.

In September, 1909, Mr. De Viguier published an excellent design for a launch engine, again with first-class drawings.

Perhaps the best draughtsman and designer of them all, the late Henry Muncaster, over a long period produced a whole series of excellent designs for stationary engines ranging from Beam and Grasshopper engines to High Speed Verticals and Horizontal Winding engines, all of which are well worth reproducing; his articles, too, on valve gears have never been equalled, except by the late G. S. Willoughby's classic series on Stephenson launch-type link gear. These valve gear articles of Muncaster's are the only serious and comprehensive series ever to be published in THE MODEL ENGINEER in the 48 years of its existence, and almost the only series that dealt at all adequately with the subject of Corliss valves and gear and independent cut-off slide valves and gear, including flywheel governor operated eccentrics.

Twining's beautiful "Gooch" was another first-class job, but could stand certain front end modernisation, and certainly an orthodox coal-fired locomotive boiler.

At the risk of being regarded as a bewhiskered backwoodsman, I think that there are without any doubt far more first-class designs to be found in THE MODEL ENGINEER prior to 1920 than since, and, in passing, I would refer to the late E. L. Pearce's "Dunalastair III." With very little alteration indeed, a locomotive built to that design could hold its head up in any company to-day with any model *not disposing of more weight on the driving wheels.* That design is 45 years old: it was published in 1901.

I have mentioned but a few high spots; there are many, very many, more. Can something be done to bring them to the notice of the modern generation?

Yours faithfully,

Harrow. K. N. HARRIS.

Clubs

Cardiff Society of Model and Experimental Engineers

At our last meeting most of the evening was spent in discussing the Exhibition, held this year in conjunction with the Cardiff West End Model Yacht Club and the Cardiff Model Aero Club.

Several new members enrolled during the show were present, and were welcomed by the chairman.

Meetings are held on the first and third Wednesdays of the month.

Hon. Sec.: F. B. ANGWIN, 47, Romilly Crescent, Cardiff.

Portsmouth Model Engineering Society

At the December 4th meeting, held at the Lecture Room, Central Library, Mrs. G. M. Walker, a club member, presented the Grant Dalton Shield to Mr. S. Farley, the winner of the Nomination and Steering Competitions held on the Canoe Lake on November 16th. The runners-up prize, presented by Mr. Wilson, was won by Mr. C. H. S. Chandler.

The chairman, Mr. T. A. Bedford, made a reference to the Society's magazine which was being published in the new year the Editor being Cmdr. L. A. Brown, R.N.V.R.

The meeting closed with a lecture on Cutting Tools, the second in this series, by Mr. G. Hodgson.

Mr. G. Hodgson's lecture with diagrams and a display of the tools discussed in the lecture, which also covered the grinding and polishing of optical and camera lenses, was greatly appreciated by all present, and Mr. Hodgson's knowledge and experience on this subject was ably demonstrated.

The Society, at the invitation of the Portsmouh Education Committee, staged a show of models covering all sections of the Society's activities at the conference on "Adult Education" held at the Training College, Milton, on December 7th.

Mr. S. Summerscales was re-elected to the executive committee.

All enquiries to the Hon. Sec.: H. A. HANDSFORD, 5, Milton Road, Portsmouth.

The Worcester and District Model Engineering Society

At recent meetings we have enjoyed lectures from Mr. S. Hunter on "Gauge 'O' Model Railways," and from Mr. Wyard (Jnr.) on "Drilling and Rifling Long Holes."

It has been decided to hold a Jumble Sale for the benefit of the Club Funds during January or February, 1947, and an exhibition of members' work either in April or May, 1947. The venue and final date will be announced later.

Hon. Sec.: J. L. FUDGER, 23, Camp Hill Road, Worcester.

Vauxhall Motors Recreation Club

At our December meeting, Mr. E. T. Westbury's talk on "Flash Steam," was much appreciated, and many questions were asked and ably answered by Mr. Westbury.

Next meeting, January 21st, Mr. Fuller, of Bassett-Lowke's staff, will give a talk on "Model Locomotives."

Hon. Secretary: JAMES TEMPLE, 15, Felstead Way, Luton, Beds.